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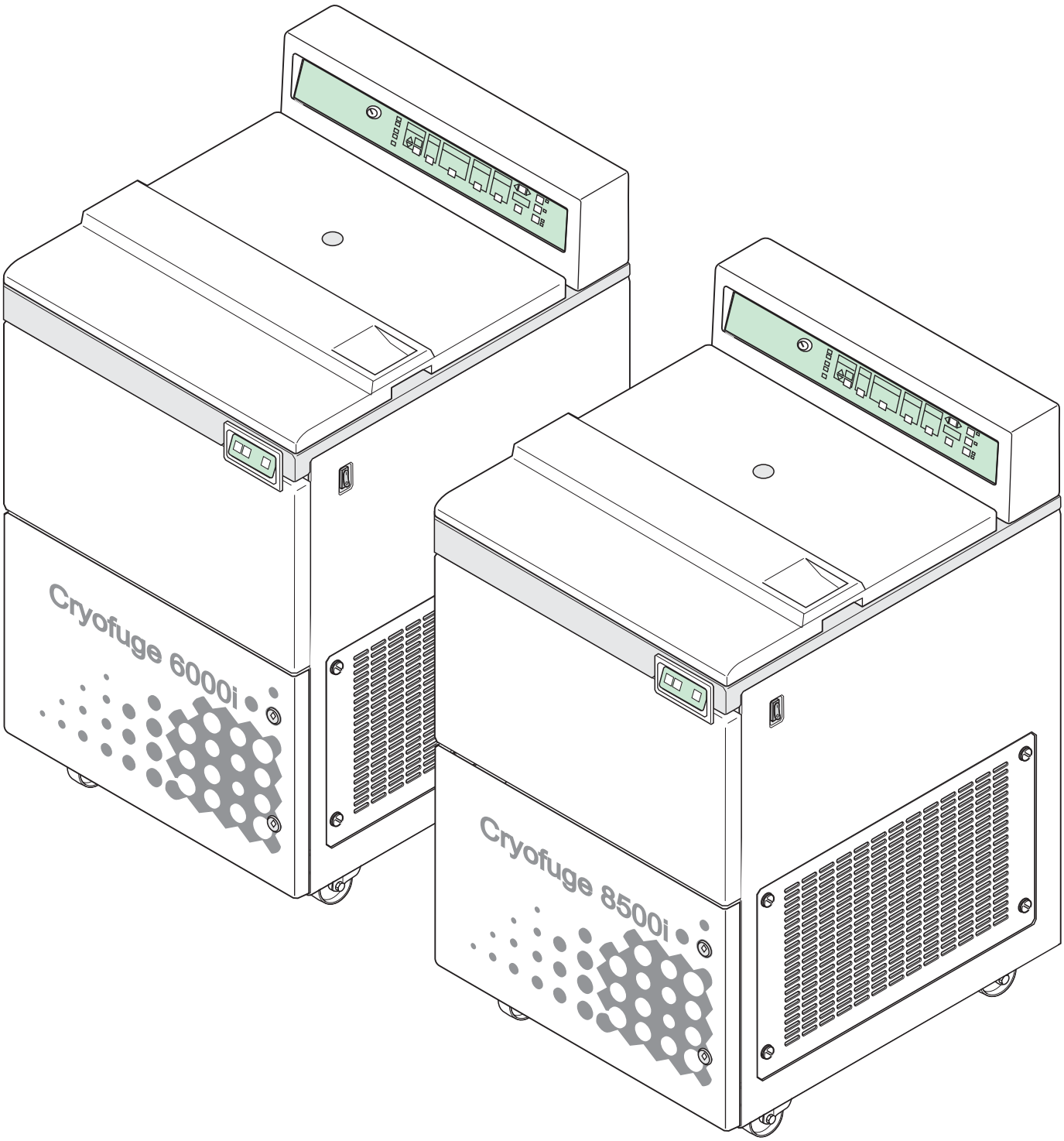
Laboratory Products

Service Manual



CRYOFUGE 6000i / 8500i

Cat.No.: 75007520 / 75007521 / 75007526 / 75007550 / 75007551

PN 12007520

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Important Note

Technical Information for use of Cryofuges 6000i/8500i

Cat. No. 75007520 Cryofuge 6000i 3 x 400V 50/60Hz – 4,2kW
Cat. No. 75007521 Cryofuge 6000i 3 x 230V 50Hz – 4,4 kW
Cat. No. 75007526 Cryofuge 6000i Single Phase 230 V 50 Hz – 3,6 kW

Cat. No. 75007550 Cryofuge 8500i 3 x 400V 50/60Hz – 6 kW
Cat. No. 75007551 Cryofuge 8500i 3 x 230V 50Hz – 6 kW

Required door-width :	80 cm
Dimensions :	800 mm x 905 mm without wooden palette
Weight :	Centrifuge 430 kg / Rotor 60 kg
Ground pressure :	approx. 1450 N/m^2
Noise Level:	CF 6000i - <64 dB(A); CF 8500i – <67 dB(A)
Voltage :	3 x 400V, 50/60 Hz, N capable handling
Required Fuses :	32 Amp slow blown
Connection 3 x 400V :	Plug Cekon Type CEE 17, 32 A-6 H 3 L + N + PE or directly installed via master power switch
Voltage :	3 x 230V/ 50 Hz
Required Fuses :	32 Amp. slow blown
Connection 3 x 230V :	Plug Cekon Type CEE 17, 32 A-9 H 3 L + PE or directly installed via master power switch
Voltage :	Single Phase 230 V/50 Hz
Required Fuses:	32 Amp. slow blown
Connection 1 x 230V	without plug

Heat rejection to environment :	15.120 kJ/h (14.330,993 BTU) CF 6000i 19.440 kJ/h (18.425,562 BTU) CF 8500i 12.960 kJ/h (12.283,708 BTU) Single Phase

HS/Cf 1e

Heraeus

CRYOFUGES®

LARGE VOLUME REFRIGERATED CENTRIFUGES

Precision for practical work: in blood banks and biotechnology.

Quality Products. Lifetime Care.

Kendro Laboratory Products

CRYOFUGE 6000i REFRIGERATED CENTRIFUGE

The Cryofuge 6000i is an attractively designed, large volume floor standing refrigerated centrifuge by Kendro Laboratory Products offering optimised technology for lowspeed applications.

It is ideal for use in blood banks, biotechnology and the pharmaceutical industry, where large volumes are centrifuged at high speeds and constant temperatures. It is also used for routine separation tasks in laboratories and production facilities.

The use of sophisticated microelectronics systems and high strength materials for rotors and accessories guarantees outstanding reproducibility and highly accurate centrifugation.

With a large 6 litre capacity and a top speed of 4240 rpm (6010 x g), the Cryofuge 6000i is designed for a wide range of separation tasks. It can accommodate 1.5 ml tubes, 1 litre containers and quad blood bags.

The Cryofuge 6000i is competitively priced and comes with a wind-shielded rotor and an extensive range of accessories. Back up from an international support and service organisation ensures maximum performance and reliability.

Typical applications
The Cryofuge is designed, in particular, for the qualified production of human blood components in blood banks. It is also used for blood fractionation, serum extraction, radio immuno assays (RIA), cell preparation, fractionating protein and enzyme precipitates, separating fine crystal deposits – and in fact, in every situation where high performance and capacity are required.

Powerful technology
The Cryofuge is equipped with a powerful, maintenance free induction drive for quiet and smooth operation. Its refrigeration system uses the environmentally friendly CFC free refrigerant R 404a.

Acceleration and braking times have been optimised for all application requirements. An automatic digital temperature compensation system prevents samples from freezing.

The Cryofuge 6000i Refrigerated Centrifuge is used for the qualified production of human blood components in blood banking.

User friendly
A new automatic lid lock enables the Cryofuge to be closed easily. The ergonomically designed keypad allows simple entry and storage of operating parameters. Main control functions are conveniently arranged for easy access, while the SEPACONTROL® control system makes operation straightforward. The "delay" function permits users to delay system start-up.

Microprocessor control
The Cryofuge is equipped with 33 centrifugation programs for routine applications. Nine acceleration and nine braking profiles ensure reproducibility of all centrifugation parameters. The Cryofuge is now also equipped with a profile program for defining up to 10 cut-off points with time, speed, braking and acceleration curves. Speed is controlled digitally with automatic RCF adjustment. Centrifuges can also be connected to a computer for data recording via a serial interface.

Safety
When designing the Cryofuge, all international safety standards were kept in mind to guarantee the highest level of safety. Diagnostic and fault messages are clearly visible. Pre-selection of buckets protects against overspeeding. The lid lock system and steel armoured rotor chamber further ensure safe operation. A key operated switch safeguards against unauthorised use.

Service friendly
The Cryofuge is equipped with a digital self diagnosis system for monitoring operability. If a fault is detected, a message is immediately displayed. Should an error occur, however, our fast and efficient international service team can be relied upon.

**Conveniently arranged function keys and easy to read digital display for simple operation and quick access.
Ergonomically designed keypad allows simple reproduction of operating parameters.**

Keys for controlling basic functions are also located on the front of the Cryofuge for immediate access.

Convenient operation
The SEPACONTROL operating panel is systematically arranged, clearly displays all functional areas and permits easy access to operating parameters. The user simply presses a few keys to select the required centrifugation program and start the Cryofuge. A design which eliminates knobs and dials ensures high reproducibility and easy cleaning of the control panel.

SEPACONTROL provides users with up-to-date information on the status of the system. Visual diagnostic indicators and acoustic signals supplement the information supplied by the microcomputer. This makes it easy to use the centrifuge right from the start.

Key operated switch
This switch protects programs against unauthorised access. Depending on the position of the switch, users are either permitted to freely program the system, call up one of the 33 programs in memory or simply repeat the program last used.

Panel
Five visual displays facilitate the identification of problems during centrifugation. When the lid is opened (check lid), the rotor is unevenly balanced (imbalance), in the event of a system error (system check), programming error (progr. error) or if the temperature limit has been exceeded (overtemp), an LED signals a warning.

Memory control
33 memory locations are available to save run parameters for future use. New programs generated using the function panel can be immediately added to the library.

Status
The status field is systematically arranged into the following areas: start-up and braking curves, speed and rotor data, time and temperature. LEDs prevent the user from confusing the values on the display.

Programming
The programming field permits easy setting of the required parameters. Only 5 keys are required for completely programming all parameters! The keys are used for changing the display setting, values displayed and confirming input.

Wind-shielded rotor and lid, showing a selection of the extensive range of buckets and adaptors.

Simple, functional operation
The basic functions for opening the centrifuge lid, starting and stopping the system and quick-stop are located on the front of the Cryofuge for immediate access.

Rotor and accessories
An aerodynamic wind-shielded rotor and 6 different types of bucket ensure maximum performance and flexibility. The wind-shielded rotor is included in the basic centrifuge package. The vast range of accessories is listed in the tables overleaf.

Four buckets have been specially developed for centrifuging blood and producing thrombocyte concentrates. The system can handle all standard blood pack systems. Additional accessories such as plastic inserts and balancing accessories round off the package.

Two other buckets used in combination with various adaptors permit all tubes with nominal volumes between 1.5 ml and 1000 ml to be centrifuged.

HERANET data documentation
The Heraeus HERANET data documentation system is available for data documentation in accordance with GMP. Please request our HERANET brochure from your Kendro representative.

CRYOFUGE 6000i GMP AND 8500i GMP

The Cryofuge 6000i GMP (Good Manufacturing Practice) offers the same performance and accessories as the Cryofuge 6000i. The Cryofuge 8500i GMP attains a maximum centrifugal force of 8525 x g and a maximum speed of 5050 rpm. GMP Cryofuges are specially designed for use in clean room applications.

Special features of the Cryofuge 6000i GMP and 8500i GMP
The special encapsulated casing is sealed to prevent particles from escaping and contaminating the clean room. The space between the centrifuge and floor is equipped with a rubber gasket. Thanks to its special smooth finish, the casing is very easy to clean. The 6000i GMP and 8500i GMP are equipped with connections for an external cooling water system; the flow rate of the cooling water is kept to a minimum. On request, the system can be connected to an external cooling system. The enclosed and sealed casing and vibration insulation system ensure low noise generation during operation. Heat radiation is also minimised.

Before installing the Cryofuge GMP, please be sure to contact the Kendro Service Department.

Double bucket for blood packs – Order no. 75007617

Model	Cryofuge 6000i	Cryofuge 8500i
Max speed (rpm)	4,000	4,000
Max. RCF (x g)	5,312	5,312
Max. capacity	2 x 800 ml	2 x 800 ml
Max. perm. mass (g)	3,500	3,500
Min. temp. at max. RCF*	–5 °C	–5 °C
Max. acceleration time (s)	140	140
Min. braking time (s)	180	180
Radius (cm)	29.9	29.9

Technical data	
Operation with blood packs	double-quint
No. of pack systems/bucket	2
Polyamide plastic inserts:	
Order no. M[2]	76007667
Opening M (mm)	110 x 57
Order no. L[1]	76007647
Opening L (mm)	110 x 70
Order no. XL[3]	76007657
Opening XL (mm)	110 x 76
Order no. XXL[4]	76007677
Opening XXL (mm)	110 x 88

Double bucket for blood packs 75007617

* At ambient temp. of 25 °C
M, L and XL plastic inserts come complete with balancing weights 75007645. One set of balancing weights includes 4 weights of 6 and 15 g each. Balancing plates 75005759 can be used to compensate big weight differences. One set includes 2 plates at 35 and 65 g each.
The balancing insert 75007668 consists of an XL plastic insert, 2 balancing weights and 30 balancing plates, enabling compensation of up to a full bucket load.
[1] Suitable for triple and quad systems.
[2] Suitable for double systems.
[3] Suitable for quad systems, systems with soft filters.
[4] Suitable for quad and quintuple systems, systems with filters.

Double bucket for blood packs – Order no. 75006694

Model	Cryofuge 6000i	Cryofuge 8500i
Max speed (rpm)	4,240	5,050
Max. RCF (x g)	5,768	8,182
Max. capacity	2 x 750 ml	2 x 750 ml
Max. perm. mass (g)	3,700	3,700
Min. temp. at max. RCF*	–4 °C	+6 °C
Max. acceleration time (s)	150	190
Min. braking time (s)	190	220
Radius (cm)	28.7	28.7

Technical data	
Operation with blood packs	double-trip.
No. of pack systems/bucket	2
Opening measurements (mm)	99 x 70
Plastic insert order no.	75006695
Plastic insert opening (mm)	95 x 60
Plastic insert material	PE

Double bucket for blood packs 75006694

* At ambient temp. of 25 °C
Bucket for blood packs 75006695 comes with plastic insert 75006694.

Double bucket for blood packs – Order no. 75006801

Model	Cryofuge 6000i	Cryofuge 8500i
Max. speed (rpm)	4,000	4,000
Max. RCF (x g)	5,170	5,170
Max. capacity	2 x 750 ml	2 x 750 ml
Max. perm. mass (g)	3,100	3,100
Min. temp. at max. RCF*	–5 °C	–5 °C
Max. acceleration time (s)	140	140
Min. braking time (s)	180	180
Radius (cm)	28.9	28.9

Technical data	
Operation with blood packs	double-trip.
No. of pack systems/bucket	2
Opening measurements (mm)	99 x 139
Plastic insert order no.	75006609
Plastic insert opening (mm)	99 x 57
Plastic insert material	PP

Double bucket for blood packs 75006801

* At ambient temp. of 25 °C

Double bucket for blood packs – Order no. 75006680

Double bucket for blood packs 75006680

Model	Cryofuge 6000i	Cryofuge 8500i	Technical data	
Max. speed (rpm)	4,000	4,000	Operation with blood packs	double-trip.
Max. RCF (x g)	5,310	5,310	No. of pack systems/bucket	2
Max. capacity	2 x 700 ml	2 x 700 ml	Opening measurements (mm)	95 x 55
Max. perm. mass (g)	3,100	3,100	**Accessories:**	
Min. temp. at max. RCF*	–5 °C	–5 °C	Metal handles	75006728
Max. acceleration time (s)	140	140	Rubber spacer for shorter packs fitted with handle 75006728	76014725
Min. braking time (s)	180	180		
Radius (cm)	29.7	29.7		

* At ambient temp. of 25 °C

Double rectangular bucket 76008078

Additional accessories for blood pack operation	
Order no. 75006683	Pack of "shoe horns" for inserting blood packs, incl. 1 set of rubber rings
Order no. 75006684	Set of non stick plastic bags (150 each) for smooth insertion and removal of blood packs
Order no. 75006681	12 rubber volume compensation plates
Order no. 75005759	4 rubber balancing plates

Double rectangular bucket – Order no. 76008078/75015501

Double rectangular bucket 76008078 with adaptors for standard tubes

Model	Cryofuge 6000i	Cryofuge 8500i
Max. speed (rpm)	4240/3006	5050/3006
Max. RCF (x g)	4984/2506	7070/2506
Max. capacity	24 x 15 ml/3 racks[1)]	24 x 15 ml/3 racks[1)]
Max. perm. mass (g)	2500/1800	2500/1800
Min. temp. at max. RCF*	–4 °C	+6 °C
Max. acceleration time (s)	150	190
Min. braking time (s)	190	220
Radius (cm)	24.8	24.8

* At ambient temp. of 25 °C
[1)] Boehringer Mannheim or Hitachi-5 sample racks

Accessories for standard tubes in double bucket 76008078

Nominal volume of tube (ml)	1.5	7	7	15	15	15	25	25	50	50	50	50	50	100	150
No. of tubes per adaptor	40	20	12	12	11	6[1)]	5	4	2	2	6	2	1	1	1
No. of tubes per rotor	480	240	144	144	132	72	60	48	24	24	36	24	12	12	12
Type of tube	ML	DIN	B. Coll.	DIN	B. Coll.	Falc.	DIN	Univ.	DIN	Falc.	Falc.	Univ.	Oil	DIN	DIN
Max. length of tube (mm)	45	110	110	111	109	121	100	120	130	120	117	120	S	120	120
Max. tube ø (mm)	11	13	14	17	17	17	25	25.5	35	29.5	29	29.5	S	45	55
Max. cap ø (mm)	–	14	18	18	19.5	23	25.9	31	36	37.5	35	37.5	S	48	–
Colour of adaptor	black	yellow	grey	red	white	brown	orange	green	green	gr./yel.	nat.	gr./yel.	nat.	blue	black
Adaptor order no. (7500xxxx)	5335	5321	5330	5322	5327	5387	5323	5391	5324	5386	2261	5389	5339	5325	5326
Stand. tube order no. (7500xxxx)	1163[a)]	9001[b)]	–	9003[b)]	–	2845[c)]	9006[b)]	–	9005[b)]	2844[e)]	2844[e)]	–	3113[d)]	9007[b)]	1132[b)]
	C	F/R	F/R	F/R	F/R	C	F/R	F/R	F/R	F/C	C	F	S	R	R

[1)] Make sure that the bucket swings out correctly when all places are used.
Type of tube: ML = microlitre tube; B. Coll. = blood collection tube ("Vacutainer", "Monovette", etc.); Falc. = "Falcon®" (conical tube); Oil test = oil test tube, pear shaped; Univ. = universal container (with vertical edge, Falcon type).
Standard tube: [a)] 1.5 ml microlitre tubes, [b)] borosilicate glass, [c)] 12 ml Nunc. screw cap tube, [d)] oil test tube, pear shaped, [e)] 50 ml Falcon screw cap tube.
Adaptors can be used with tubes with the following shape bottom: F = flat, R = round, C = conical, S = special

Round bucket – Order no. 75008165

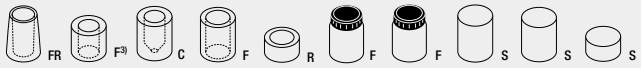
Model	Cryofuge 6000i	Cryofuge 8500i
Max. speed (rpm)	4,240	5,050
Max. RCF (x g)	6,010	8,525
Max. capacity	1 x 1000 ml	1 x 1000 ml
Max. perm. mass (g)	3,200	3,200
Min. temp. at max. RCF*	–4 °C	+8 °C
Max. acceleration time (s)	150	190
Min. braking time (s)	190	220
Radius (cm)	29.9	29.9

* At ambient temp. of 25 °C
Aerosol tight cap (order no. 75008081) available on request.

Round bucket 75008165

Accessories for large volume tubes in round bucket 75008165

Nominal volume of tube (ml)	250	250[2]	250	500	650	750	1000	1000	Bp.	DACS
No. of tubes per adaptor	1	1	1	1	1	–	1	–	1	1
No. of tubes per rotor	6	6	6	6	6	6	6	6	6	6
Type of tube	DIN	Div./H.	Corni.	H	DIN	H	H	HST	Sing.-trip.	DACS
Max. length of tube (mm)	190	190	190	190	195[3]	148	190	175	–	–
Max. tube ø (mm)	59	62.5	61.5	70	84	100	100	99.5	–	–
Max. cap ø (mm)	–	–	–	–	–	87	87	–	–	–
Colour of adaptor	nat.	nat.	nat.	nat.	nat.	-	-	-	nat.	black
Adaptor order no. (7500xxxx)	6649[4]	8144	8147	8145	6637[6]	–	–	–	6639	5254
Stand. tube order no. (7500xxxx)	1135[b]	7894	–	7718	1158[7]	8149	6613	6640	–	–



Nominal volume of tube: Bp. = blood pack, DACS = Density Associated Cell Sorting (DACS™ 300, Fresenius)
Type of tube: Div. = diverse, Corni. = Corning bottle, H = Heraeus tube, HST = Heraeus stainless steel tube
Standard tube: [b] borosilicate glass.
[2] Additional pad for conical tubes required from manufacturer, [3] Only use without cap 75008081,
[4] Pad 75001808 required, [6] Pad 75001913 required, [7] max. speed – 2,600 rpm
Adaptors can be used with tubes with the following shape bottom: F = flat, R = round, C = conical, S = special

Adaptor for large volume tubes for round bucket 75008165

Round bucket 75008165 with adaptors for standard tubes

Accessories for standard tubes in round bucket 75008165

Nominal volume of tube (ml)	1.5/2	7	7	15	15	15	25	50	50	100
No. of tubes per adaptor	48	35	19	19	17	12	7	4	4	2
No. of tubes per rotor	288	210	114	114	102	72	42	24	24	12
Type of tube	ML	DIN	B. Coll.	DIN	B. Coll.	Falc.	DIN	DIN	Falc.	DIN
Max. length of tube (mm)	42	177	177	177	177	177	177	177	177	177
Max. tube ø (mm)	11	13	14	17	17	17	25	35	29.5	45
Max. cap ø (mm)	–	14	18.5	18.5	20	23.7	31	39	39	47.5
Colour of adaptor	black	yellow	grey	red	white	brown	orange	green	gr./br.	blue
Adaptor order no. (7500xxxx)	8132	8133	8134	8135	8136	8137	8138	8140	8141	8142
Stand. tube order no. (7500xxxx)	1163[a]	9001[b]	–	9003[b]	–	2845[c]	9006[b]	9005[b]	2844[e]	9007[b]

Type of tube: ML = microlitre tube; B. Coll. = blood collection tube ("Vacutainer", "Monovette", etc.); Falc. = "Falcon" (conical tube).
Standard tube: [a] microlitre tubes, [b] borosilicate glass, [c] 15 ml Falcon screw cap tube, [e] 50 ml Falcon screw cap tube.
Adaptors can be used with tubes with the following shape bottom: F = flat, R = round, C = conical.

TECHNICAL DATA

The Cryofuges 6000i and 8500i are now even more convenient to operate with a load-relief lid for easy opening and closing.

Model	Cryofuge 6000i	Cryofuge 8500i
Description	Large volume refrigerated floor standing centrifuge	Large volume refrigerated floor standing centrifuge
Max. speed	4240 rpm	5050 rpm
Max. RCF	6010 x g	8525 x g
Max. capacity	6 x 1000 ml bottles or 12 blood pack systems of 800 ml each	6 x 1000 ml bottles or 12 blood pack systems of 800 ml each
Control and drive	High performance induction drive, SEPACONTROL with microprocessor	High performance induction drive, SEPACONTROL with microprocessor
Acceleration and braking profiles	9/10 profiles	9/10 profiles
Runtime	1 min – 99 hrs, continuous operation	1 min – 99 hrs, continuous operation
Program memory	33 user centrifugation programs, one of which with freely combinable braking and acceleration curves, key operated switch for protection against unauthorised access, data last used saved, in the case of a power interruption data saved for unlimited period of time.	
Temperature control range	–20 °C to +40 °C	–20 °C to +40 °C
Safety features	Lid lock and interlock, imbalance cut-out, steel armoured chamber	
Design	Sturdy, torsion resistant steel design with stainless steel rotor chamber	
Dimensions (hxwxd)	1178 x 800 x 905 mm	1178 x 800 x 905 mm
Weight (excl. rotor)	445 kg	445 kg
Power consumption	4.2 kW	5.4 kW
Refrigeration unit	1.9 kW	1.9 kW
Recommended fuse	25A	25A
Designed and tested in acc. with	IEC 1010, UVV VBG 20, UVV VBG 7z, UVV VBG 4, DIN 58970 part 1,2, 4, radio interference suppression in compliance with VDE 0871 B	
Rotor		
Wind-shielded rotor	75006606 included in basic package	75006606 included in basic package

ORDER NUMBERS

Order number	Cryofuge 6000i	Cryofuge 8500i
220 V/3 Ph/50 Hz	75007521	
230 V/1 Ph/50 Hz	75007526	
400 V/3 Ph/50 Hz	75007520	
GMP model		
400 V/3 Ph/50 Hz with built-in refrigeration unit	75007562	75007561
with external refrigeration unit	75007566	

Australia Kendro Laboratory Products · Lane Cove DC · NSW 2066 · Tel. +61 (02) 9936 1540 · Fax. +61 (02) 9427 9765 · info@kendro.com.au
Austria Kendro Laboratory Products GmbH · Wien · Tel. +43 (1) 801 40-0 · Fax +43 (1) 801 40 40 · office@kendro.at
Canada Kendro Laboratory Products International Sales · Newtown · USA · Tel. +1 (203) 270-2080 · Fax. +1 (203) 270-2166 · info@kendro.com
Denmark Kendro Laboratory Products AB · Albertslund · Tel. +45-43 62 46 47 · Fax +45-43 62 46 41 · info@kendro.dk
France Kendro Laboratory Products · Courtaboeuf cedex · Tel. +33 (1) 69 18 77 77 · Fax +33 (1) 60 92 00 34 · info@kendro-lab.fr
Germany Kendro Laboratory Products GmbH · Hanau · Tel +49 (6181) 35-300 · Fax: +49 (6181) 35-59 44 · info@kendro.de
India Kendro Laboratory Products (India) Pvt. Ltd. · New Delhi · Tel. +91 (11) 618 58 40 · Fax +91 (11) 618 53 97 · kendro.india@vsnl.com
Italy AHSI S.p.A. · Cavenago Brianza · Tel. +39 (02) 95 08 11 · Fax +39 (02) 95 08 12 77 · ahsidue@tin.it
Poland Kendro Spólka z.o.o. · Warszawa · Tel. +48 (22) 663 43 23 · Fax +48 (22) 663 43 25 · kendro.warszawa@kendro.com.pl
Portugal Heraeus S.A. · Cacem · Tel. +351 (1) 912 08 65 · Fax +351 (1) 912 08 60 · heraeus@mail.telepac.pt
PR China Kendro Laboratory Products (H.K.) Ltd. · Hong Kong SAR · Tel. +852 2711-3910 · Fax +852 2711-3858 · 106122.205@compuserve.com
Spain Heraeus S.A. · Madrid · Tel. +34 (91) 358 19 96 · Fax +34 (91) 358 20 67 · heraeus@mx3.redestb.es
Sweden Kendro Laboratory Products AB · Upplands Väsby · Tel. +46 (8) 59 07 21 90 · Fax +46 (8) 59 03 16 00 · info@kendro.se
Switzerland Kendro Laboratory Products AG · Zürich · Tel. +41 (1) 454 12 12 · Fax +41 (1) 454 12 99 · kendro-ag@swissonline.ch
Kendro Laboratory Products SA · Carouge-Genève · Tel. +41 (22) 343 21 67 · Fax +41 (22) 342 38 31 · kendro-sa@swissonline.ch
U.K./Ireland Kendro Laboratory Products Limited · Bishop's Stortford · Herts · Tel. +44 (1279) 827700 · Fax +44 (1279) 827750 · kendro@kendro.co.uk
USA Kendro Laboratory Products L.P. · Newtown · Tel. +1 (800) 522-7746 · Fax. +1 (203) 270-2166 · info@kendro.com

All other International Sales in Europe, Middle East, Africa
Kendro Laboratory Products International Sales · Hanau · Germany · Tel. +49 (6181) 35-300 · Fax +49 (6181) 35 59 44 · info@kendro.de
Asia Pacific Kendro Laboratory Products (H.K.) Ltd. · Hong Kong SAR · Tel. +852 2711-3910 · Fax +852 2711-3858 · 106122.205@compuserve.com
Latin America Kendro Laboratory Products International Sales · Newtown · USA · Tel. +1 (203) 270-2080 · Fax. +1 (203) 270-2210 · info@kendro.com

Internet http://www.kendro.com · http://www.heraeus-instruments.com

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2. SERVICE

2.1 Servicing Schedule (Yearly Procedure)

2.1.1 Maintenance Routine without Dismantling the Centrifuge

1. Electrical Installation and Safety
Switch OFF the centrifuge and disconnect the unit from power.
Check voltage supply and mains fusing (3 x 32 Amps slow blow characteristic or other for corresponding line voltages)
Check condition of plug and wall socket - replace defective parts.
Check main contactor for burnt out poles.
Check cord condition and fixing - replace or refit it.

2. Location and Mechanical Installation
Check the base for resonance-free and stable conditions.
Check for a well ventilated place and sufficient distances to walls or adjacent equipment (min. 30 cm), avoid direct sunlight.
Check the levelling of the centrifuge - use a spirit level.

3. Lid Locking Mechanism and Safety Device
Connect the centrifuge to power and switch ON
Check for easy lid closing and self-acting lid opening - if in disorder, re-adjust lid looped hooks and/or hinges and/or move lid lock assembly aside and smear hooks slightly with grease.
Check the central rubber gasket for lid sealing and replace it, if damaged.
Open the lid and turn the rotor by hand, then close the lid and try to open it using the lid key: the lid must not be opened as long as the speed values (> 10 rpm) are indicated - if safety circuit is out of function, replace main board.

4. Cleanliness of Spin Chamber and Motor Cover
Open the lid and remove the rotor: for loosening turn rotor's collar nut with use of 19 mm fixed spanner anti clock wise (in arrow direction - see rim of rotor bowl), thereby hold the rotor on it's cross.
There is an additionally turn resistance after approx. one revolution which has to be overcome with an further lever pressure of the fixed spanner. Then turn the drive shaft clockwise with the 10 mm socket wrench as long as the rotor can be lifted up. Two persons are necessary to seize the rotor by it arms on opposite and to lift the rotor carefully out of the bowl.
Clean the wind-shield with a dry and absorbent cloth (remove all dust and moisture - see also 2.5 Cleaning)
Check the correct seat and condition of the motor cover.
Take care of the cleanliness of the annular slot around the motor shaft: there is shaft packing of felt which has to be soaked with oil. - Penetrating fluids can damage the upper motor bearing.

5. Rotor and Bucket Condition and Sealing
Check the condition of rotor and buckets (especially all supporting or stressed partitions as jib arms, rim of the bucket's bearing surface etc.): the rotor and/or buckets must not be used any longer, if there are visible traces of mechanical damage or rust.
Check the condition of rotor and/or bucket sealing and replace them in case of malfunction

6. Rotor Fixing and Motor Shaft
Check the condition of the drive motor shaft: the centrifuge must not be used any longer, if the drive shaft is damaged (bend, thread is worn out, horizontal grooves etc.)

7. Temperature Control Circuit
Clean the condenser (use a vacuum cleaner).
Check the thermal isolated fixing of the temperature sensor.
Re-install the rotor and run the centrifuge at 2000 rpm (1500 rpm with buckets #7719) and at 4°C
Check the temperature 30 minutes later: the displayed and measured value should be approximately the same (tolerances +/-2K)

2.3.2 Maintenance Routine after Dismantling the Centrifuge Casing (see Section 5)

1. Motor Supporting Elements
Check the supporting and damping motor elements (enlarged rubber abrasion, often imbalance runs) and replace them by worse condition or at least every 3 years.

2. Imbalance Switch
Check the function of the imbalance switch and replace in case of malfunction.

3. Braking Circuit
Check the function of the braking circuit (warming up of brake resistor, even and noiseless brake effect) and replace defective parts in case of malfunction.

4*. Lead and Screwing Connections*
Check the terminal and plug connections of leads on all boards and electrical components, replace defective parts.
Check the screwing connections of boards, mechanical and electrical components and tighten them if necessary.

5. Protection Earth Core and Grounding Connections
Check the protection earth core for continuity and all grounding plug connectors (see also 2.6 Electrical Safety Check).
Check insulation resistance and measure the substitutional leakage current (see 2.6)

Trouble Shooting

Error Indication	Error Cause	Possible Error Source	Corrective Procedure
"check lid" LED on, **interval sound**	lid opened mechanically during run FORBIDDEN!	mechanical emergency lid opening must only be used at standstill	close lid immediately, turn power OFF/ON, press start to continue run, press stop to finish run
	circuit for lid switches interrupted **during run**	lid switches or leads are interrupted	check leads to the lid switches, if micro switch is faulty, change lid lock assembly
"check lid" LED on and **"OPEn"**	15 V circuit for lid switches is interrupted **at standstill**	1) leads to lid switches interrupted or defective lid switch	1) check leads to lid switches, if micro switch is faulty - replace lid lock assembly
"imbalance" LED on, **interval sound**	imbalance circuit has released	1) rotor not symmetrically loaded	1) open lid, check load, close lid again and start
		2) base is not sturdy enough and comes into vibrations	2) change or reinforce the base
		3) centrifuge is not correctly levelled	3) level the centrifuge drive correctly, use a spirit level on top of installed rotor
		4) disjusted or faulty imbalance switch	4) readjust imbalance switch or replace in case of malfunction
		5) leads to imbalance switch are interrupted	5) check leads with ohmmeter and replace if faulty
		6) faulty component of imbalance circuit	6) replace main board
"overtemp" LED on, **interval sound**	**just after starting**: drive is switched off	Δt alarm	Rotor chamber must be precooled before Δt activation
	during longer operation: rotor coasts to standstill without braking	1) Δt is programmed	1) check minimum reachable temperatures at maximum speed and 20°C, check cooling plant in case of big deviation
		2) without programming of Δt	2) check compressor and cooling plant (loss of refrigerant)
E-00 appears **system check** LED on and interval sound	rotor didn't turn	1) rotor is jammed	1) check for easy movement, remove any jamming objects
		2) motor is jammed	2) remove drive, replace faulty parts
	faulty speed signal **easy check:** turn rotor by hand and close lid - speed values must be indicated	1) faulty plug or lead connections or faulty speed detection board	1) check plug contacts and leads - measure speed detection signal on XW1, XW3 - replace faulty parts
		2) faulty processing circuit on main board	2) replace main board
	motor didn't start	1) connection: drive to main board	1) check terminal and lead connections, replace faulty parts
		2) defective drive	2) check resistance of motor windings, replace faulty parts
		3) faulty main board	3) replace main board

Trouble Shooting

E-02 flashes **system check** LED on and interval sound	program sequence disturbed	bad ground connection	check all ground connections, tighten loose screws
E-03 flashes **system check** LED on and interval sound	faulty speed signal **during run**	see E-00 or e.g. missing rotor	wait until rotor has come to standstill, then see E-00
E-04 flashes **system check** LED on and interval sound	faulty temperature measuring	1) faulty temperature sensor (PT100) or leads	1) check plug connection and resistance of PT 100, replace faulty sensor
		2) defective amplifier or converter test: substitute PT100 by 100Ω and 120Ω	2) set the temperature to 20 °C and watch the display: after power ON 100Ω ->(0±2)°C 120Ω ->(50±2)°C replace defective main board
E-06 flashes **system check** LED on and interval sound	data lines to keyboard disturbed during operation	1) faulty plug contact or connecting leads	1) replace plug contacts or connecting leads
		2) faulty tracks or components	2) change key and indication board or main board
E-08 flashes **System check** LED on and interval sound	over **voltage** in DC intermediate circuit	1) leads to brake resistor interrupted or defective resistor	1) check leads and brake resistor, replace defective parts
		2) faulty intermediate circuit	2) replace main board
	over **current** in DC intermediate circuit	1) defective motor	1) disconnect the motor, check motor windings, replace defective motor
		2) faulty frequency converter	2) replace main board
	over **temperature** of the electronics	insufficient cooling of power electronics	check wall distance, air ventilation and fan function, change bad conditions, replace defective parts
E-10 appears **system check** LED on and interval sound	program sequence disturbed	NV-RAM not initialised	insert the correct NV-RAM
E-12 flashes **system check** LED on and interval sound	temperature signal disturbed	see E-04	see E-04
E-15 appears **system check** LED on and interval sound	program sequence disturbed	reading error of NV- RAM (checksum)	if error indication occurs repeatedly replace NV-RAM
E-17 appears **system check** LED on and interval sound	micro switch didn't open after pressing lid key	1) faulty leads or micro switch	1) replace defective parts
		2) defective lid lock	2) replace lid lock assembly
E-22 appears **system check** LED on and interval sound	NV-RAM and micro controller can not cooperate	micro controller or NV-RAM are mixed up	check the correct identification No's of micro controller and NV-RAM

Trouble Shooting

E-23 appears **system check** LED on and interval sound	mains contactor **didn't pull up**, hour counter **doesn't run**	1) interruption of the mains security path	1) check F3,F4,F5 and closing contacts of K2 inclusive all connecting lines and replace defective parts
		2) defective driving of mains contactor	2) replace contactor or main board
	mains contactor **has been cut off**, rotor coasts to standstill without braking	main security path is interrupted by one of the safety elements: 1) F3: compressor's over current protection	1) F3: check main phases, measure the compressor current and compare with adjustion of protection switch, check compressor windings, replace defective compressor
		2) F4: motor over temperature switch	2) F4: check air ventilation and motor windings, replace defective parts
		3) F5: over pressure switch of cooling plant	3) enlarge the lateral wall distance, clean conden-ser, replace defective fan or make clogged injection valve free
	mains contactor **has pulled**, hour counter **runs**, rotor doesn't start or coasts to standstill without braking	1) missing mains phase for supply of frequency converter or defective 35 slow blown fuse	1) check mains phase or replace defective fuse, if it blows again check for other faults (drive resistance's, intermediate circuit), replace defective parts
		2) faulty driving of preloading for intermediate circuit	2) check the switching action of relay K1 and replace main board in case of malfunction
displays **remain** dark	no **mains** voltage supply	1) Phase L2 or fuse F2 failed	1) check phase and fuse or circuit breaker and if faulty, replace or switch on again
		2) defective mains cord or mains switch	2) check leads and switch, replace defective parts
	no **low** voltage supply for key and display board	1) faulty connection from main board to key board	1) check plug connections on main and key board, check connecting leads - replace faulty parts
		2) faulty keyboard	2) replace keyboard
		3) faulty main board	3) replace main board
	interrupted program sequence	NV-RAM out of socket or not correctly inserted	insert the right NV-RAM correctly
all displays **elements** are **shortly illuminated**	**processor reset** caused by electromagnetic disturbance	1) reduced voltage supply (< 10%)	1) if the voltage supply drops often, use a voltage stabiliser
		2) bad or missing ground connection	2) check all ground connections and screwings of main board

Trouble Shooting

drive makes noises - no good centrifugation results	**mechanical**	1) wear out of motor rubber mounts	1) replace motor rubber mounts (damping elements)
		2) motor bearing	2) replace motor
	electrical	1) defective terminal connection or faulty lead or mot. winding	1) check voltage on motor terminal (see test points on main board), replace defective parts
		2) defective driving circuit	2) replace main board
drive accelerates but **doesn't brake** normally - (noisy braking)	faulty brake circuit	1) defective lead or brake resistor	1) check connection and leads and brake resistor 25 Ω , replace faulty parts
		2) defective brake control circuit	2) change main board

2.3 Test Points on Main Board

Test Points	Unit Value	Condition
1) mains terminal XT (L2 for low voltage supply) **2) mains terminal** L1 to N (or 2nd phase)(intermediate circuit)	230 V AC 230 V AC (-/+10%)	all given values refer to 230V
terminal **XM 1 to XM 3** **motor voltage** measured inter 2 motor leads - voltage values must be the same between all 3 motor leads after the selected speed is reached	 260 V AC 255 V AC 245 V AC	 rotor 75006606 with buckets 75008078 1 000 rpm 2 500 rpm 4 240 rpm, acc. time: 95s, dec. time: 180s
motor current		soft iron or moving-iron or digital effective current measuring instrument
cable 1 cable 2 cable 3	8.0 A 8.0 A 8.0 A	rotor 75006606 with buckets 75008078 set speed = 4 240 rpm
max. acceleration current	15 A	rotor 75006606 with buckets 75008078 (in the speed range of 2000 to 3000 rpm)
intermediate circuit voltage U_D **bridge rectifier V49**	320 V DC 355 V DC	at standstill during braking phase
	300 V DC 280 V DC	rotor 75006606 with buckets 75008078 set speed = 4 240 rpm shortly by max. acceleration
current of intermediate circuit through **control resistor R29** measured as voltage drop: U = I x R	 8.5 mV DC 31 mV DC 103 mV DC 250 mV DC -12 mV DC	 rotor 75006606 with buckets 75008078 set speed = 1 000 rpm set speed = 2 500 rpm set speed = 4 240 rpm shortly by max. acceleration shortly during braking phase
motor winding **resistance** inter 1 -> 2, 2 -> 3 and 1 -> 3	0.5 Ω	motor temperature: 20 °C
plug **XD** resistance of brake resistor	25 Ω	resistor temperature: 20 °C
plug **XE** imbalance switch voltage drop inter pin 1 and 4	 6.5 V DC 12 V DC 0 V DC	installation: mechanically closed, electrically opened plug inserted, open switch (no imbalance) plug removed, or leads interrupted (imbalance message) switch closed (plug re-inserted, active imbalance signal)
plug **XW** voltage drop speed detection board inter pin 1 and 3: inter pin 1 and 2:	 12.0 V DC 10.7 V DC 0.3 V DC	 active circuit U_B transistor is cut in (slot position) transistor is cut out speed signal: two pulses per revolution
terminal **XC** resistance of lid solenoid terminal **XC1/XC2**	 120 Ω 8 Ω	 2 x 240Ω parallel – old version latch motor pin 3 to 4

Test Points on Main Board

plug **XA** micro switches for lid locking	30 V DC	by open lid
terminal **XB** motor over temp. switch	230 V AC	contact open
terminal **XN** compressor thermal over current switch	230 V AC	contact open
terminal **XO** pressostat	230 V AC	contact open
plug **XU** voltage drop on PT100	95 mV DC	20 °C temperature indication
compressor terminal box 1) voltage 2) current 3) resistance of compressor winding between **C + R (C + P)** between **C + S (C + A)** between **R + S (A + P)**	 3 x 400 V AC; 3 x 230 V AC; single phase 230V (depending on version) 3 x 3.8 A (400 V) 3 x 7,5 A (230 V) 7,5 A (single-phase) 3 x 400 V ; 3 x 230 V; 1 x 230V 6 Ω 1,8 Ω 1,9 Ω 6 Ω 1,8 Ω 6,4 Ω 6 Ω 1,8 Ω 7,9 Ω	 if contactor K3 has pulled after 2 minutes run at room temperature at 20 °C compressor temperature 20 °C

2.4 Adjustment of Imbalance Switch

2.4.1 Meaning of Imbalance Switch

The imbalance switch has the task to switch off the centrifuge by incorrect loading of the rotor before reaching the normal speed.

NOTE!
1) Before starting with the re-adjustment procedure check the greasing of rotor trunnions and cleanliness of bucket groves. Opposing buckets and racks must be identical and equal in weight.

2) Check the motor's rubber mounts and the levelling of the drive with installed rotor (use a spirit level).

2.4.2 Adjusting Procedure

Tools and accessories:

Rotor 75006606 with buckets 75008078

check weights: 40g + 80g

Procedure

Disconnect unit from power and open the front door.

Loosen both M6 screws on bottom of mounting angle of imbalance switch to keep it movable.

Pull imbalance assembly away from the drive.

Move the assembly very slowly in direction to the drive until a clicking noise is audible.

Refix both screws and start the test run.

2.4.3 Test Run Performance

Install the rotor 75006606 with all buckets 75008078.

Load one bucket with the check weight of 80g.

Close the lid, select acceleration curve 9 and then press the start key.

The imbalance message "bal" must appear when passing 1400 rpm.

If no imbalance signal occurs, correct the adjustment by pulling the assembly a little away from the drive.

Exchange now the 40g weight and repeat the procedure.

The rotor must reach the max. programmed speed without imbalance signal

NOTE!
Both imbalance tests (with 40 and 80 grams) must be performed with in the buckets 1, 3 and 5 that means 6 test runs are necessary.

2.5 Cleaning of Instrument Parts

ATTENTION - WARNING!
Do not clean the electrical and electronic components with moist cleaners!
For Cleaning the housing or accessories see Operating Instructions section 1 §10.

1) Electronic components
Clean dusty components carefully with a dry and soft brush.

2) Fans
Scratch off carefully with a knife or similar tool the crusted dirt from the fan blades. Resulting grooves or marks must be removed subsequently with a fine abrasive cloth. Loose dirt is to remove with a vacuum cleaner.

3) Condenser of the cooling unit
The vents between the heat air deflectors have to be vacuum cleaned. By persistent dirt, the unit must be carried to an appropriate place where the condenser can be cleaned from the inside to the outside with compressed air.

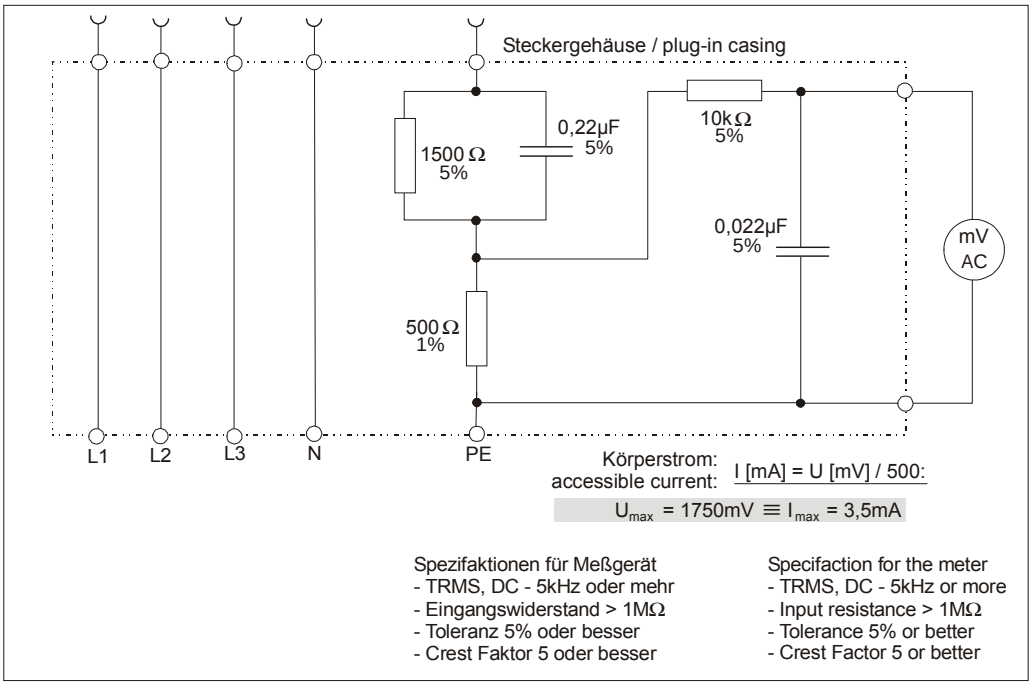
2.6 Electrical Safety Check

ATTENTION!
A final electrical safety check must be performed after each maintenance and/or repair.

Resistance check of protective conductor
The resistance between the mains plug's earthing pin and the earthing conductors of the motor, electronic chassis and the casing must not exceed 200 mΩ.

Isolation resistance Check
Check also the isolation resistance between the poles of the mains plug and the earthing conductor; the resistance value must be higher than 2 MΩ.

Accessible current measured to EN 61010
The accessible current must not exceed 3.5 mAmps in single fault condition (interrupted protection earth wire)! In accordance with the EN61010, IEC1010 and UL3101 such a fault condition can be reproduced by the following measuring circuit.



3. FUNCTIONAL DESCRIPTION

3.1 Block Functions

The Cryofuge 6000i/8500i is a microprocessor controlled and programmable floor standing centrifuge with cooling plant and induction drive motor.

Following boards and components are located inside the unit (see also block diagram section 4 page 4-1):

Mains switch S1.

Mains input angle plate with fuses F1, F2, contactors K2, K3 and hour counter h.

Main board with central processor and ASIC80 component.

Indication board with key and display processor (SEPACONTROL programming) with key switch for protection of all program parameters.

Serial interface board (RS 232) with plug connection for transferring the operational parameters to a PC or Heranet system.

Driving stage for mains contactor K2

Main security path with protection for motor overtemperature F4, thermal compressor overload F3 and overpressure of cooling plant F5.

Noise filter board.

Three phase induction drive motor with an integrated thermal overtemperature switch (cut-out at 140°C).

Speed detection board is mounted underneath the drive motor.

Imbalance switch S6 mounted aside and in front of the drive motor (for adjustment see section 2 page 2-9).

Two lid lock assemblies each with motor locking system and integrated micro switches (S2, S3 and S4, S5).

Temperature sensor V1 (PT100).

Driving stage for compressor contactor K3 (cuts in compressor M2).

Heating element as brake resistor R1 with integrated fan M6 (mounted behind the casing's back panel).

Three more Fans for cooling

a) of condenser, drive and compressor (M3)
b) of condenser also (M4, not used for models with water cooling)
c) of power electronics on main board (M5)

3.2 Contactor Plate (Mains Input)

The following components are mounted on an angle plate, they are accessible after opening the front door (see also wiring connection diagram in section 4 page 4-9 from right to left):

Terminal for protection earth (PE) connection of mains cable (yellow green).

Terminal for neutral line (N) of mains cable (blue, 400 V version only).

Screw fuse F2 (6 Amp slow blown) for protection of control circuit connected to mains phase L2 (point 3 on mains contactor) via mains switch S1.

(Second 6 Amp fuse slow blown at 3 x 230 V units)

Screw fuse F1 (20 Amp slow blown) for protection of DC intermediate circuit for the drive's power electronics connected to mains phase L1 via noise filter board.

(Second 20 Amp fuse slow blown at 3 x 230 V units)

Mains contactor K2 with 3 phased mains connection (points 1,3,5) to supply

1.) DC intermediate circuit for drive's power electronics on phase L1 (point 2)

2.) 3 pole compressor contactor K3 (terminal 2,4,6 and 1,3,5 supply via mains contactor) to switch the compressor ON and OFF via the thermal over current fuse F3 (manual reset).

Thermal over current fuse F3 attached on compressor contactor's output to protect the compressor indirectly for thermal overload (part of the mains security path, points 95,96). Selected to running current of the compressor

Two double RC combinations are fixed with tape (bilateral adhesive) on both sides of the compressor contactor to reduce the voltage spikes when switching the compressor ON and OFF (bypassing K3 **and** F3 contacts).

Hour counter h is parallel connected to the main contactor's coil to determine the operational time when the centrifuge is switch ON **and** the lid is closed. This is generally the possible condition for the compressor's operation (standstill cooling).

3.3 Main Board Functions

The main board is mounted beneath the operational panel behind the unit's back wall. The components on main board are arranged in following groups (see wiring diagram).

Triac stage for coil of compressor contactor K3

Triac stage for fan M4 of cooling plant (condenser)

Triac stage for both parallel connected lid solenoids Y1 and Y2 (old mechanical latch)

Triac stage for three parallel connected fans (M3 for condenser and drive, M5 for electronics on main board and M6 for brake resistor)

Triac stage for coil of main contactor K2 and hour counter h via main security path (F3, F4 motor overtemperature switch and F5 high pressure control switch)

Driver of new style motor latch system

Noise filter block (in interaction with the external noise filter board) for suppression of radio interference, caused by the fast switching power electronics (<10 kHz), in accordance with the German Regulation VDE 871, grade B

Bridge rectifier for DC intermediate circuit supplying brake control path and frequency converter

Power pack for 3 different low voltage levels

Microcontroller (central processing unit) in interaction with ASIC80 functions for frequency converter, speed and imbalance detection, temperature measuring and calibration

3.3.1 Power Pack

Transformer T1 with 2 different secondary coils, each connected to bridge rectifiers and voltage regulators used for the following circuits:

1.) U1 = **5**V: supplies central processor, key and indication board and temperature measuring circuit
reference potential: connected to protective conductor (**GND**)

2.) U2 = **12**V: supplies the circuits of speed measuring and imbalance detection
reference potential: **GND2**

Transformer T2 generates the low voltage supply for the power electronics:

3.) U3 = **15**V: a) contacts of relay **K1** (pre-loading of intermediate circuit)
- on troubles "**Err. 23**" will be displayed
b) and all lid switches (S2,S3,S4,S5)
- on troubles "**OPEn**" at standstill and "**LId**" during rotation will be displayed
reference potential: **UD-**

3.3.2 Intermediate Circuit with Brake Path and Frequency Converter

The DC intermediate circuit serves as an energy store between the AC power input and the transmitted motor performance.
The intermediate circuit consists of a bridge rectifier and 12 parallel connected reservoir capacitors which are softly charged at the beginning over heavy-duty resistors (R61 and R100 parallel connected). When the capacitor's loading has reached the defined value, the resistors are bypassed by the relay **K1** to supply frequency converter with maximum main power during operation.

Brake Path
Electrical power is fed back into the intermediate circuit during motor deceleration (motor acts as generator). This braking power is transformed into heat by brake resistor R1 (terminal **XD**) so that the intermediate circuit voltage does not rise to an excessive level (see section 2 - test points on main board).
The brake resistor R1 is switched into the intermediate circuit by a fast switching transistor. This transistor is voltage dependent controlled by a self-acting stage (closed loop).

Frequency Converter
The motor is 3-phased provided with chopped direct voltage blocks. These blocks are variable in frequency and pulse width modulation and are dephased to 120° between the motor windings. Beginning with low frequency and small pulse width chopped blocks, both parameters will be increased up to the operators set speed. By this variation the acceleration power of the drive motor can be effected. For deceleration the frequency and pulse width parameters will be reduced. The frequency converter is dynamically and absolutely protected against overcurrent and overvoltage and also absolutely protected against excessive temperature.
When exceeding one of the absolute values (overcurrent, overvoltage or excessive temperature), the message "**Err.08**" will be displayed.

3.3.3 Microcontroller (Central Processing Unit)

The controller block includes the central processor unit (CPU) P87C51FC and two of the data storage (NV-RAMs) 93S66 with the software identification No's. for:

CPU: 0599 (second displayed No. in speed field)

1. **NV-RAM**: 7571 (third displayed No. in speed field) 7572 in CF 8500i only

2. **NV-RAM**: 7573 (fourth displayed No. in speed field)

The second parts of these No.'s (displayed in the time field) will be upgraded if necessary.
The ROM with control program is integrated in the CPU. The most important operating parameters (e.g. the maximum data or the last operator settings) are stored in the non volatile (NV) -RAM.
The CPU co-operates with the ASIC 80 component via the 8 bit data bus and some control lines.
The ASIC 80 is a specially designed integrated circuit for the driving of Kendro centrifuges (with induction motors), containing additional functions for speed and temperature measuring and electronics protection.

3.3.4 Latch Control-system

The mainboard allows a controlling of the new electrical latch system with current software (CPU 599) and controlling of the old mechanical latch with old software (CPU 498) as well.

Note! The new Software does not control the old latch system.

Electrical latch
Both latches are connected to the board via terminal XC1 and XC2.
Each latch will be driven forward and backward via a relay by a special driver IC which changes the polarity of the voltage depending on status of the wanted operation - open or close the door.
The activating of the door latches is several times protected by addition status controls of the CPU.
The door can only be opened if the speed is “0” and the lid opening button was pushed.

Mechanical latch
These mechanical latches are connected at the terminal XC. They are controlled by a triac which is fired via photodiac by CPU. Two tachogenator signal trigged flip-flops prevent an opening of the door whilst rotor is spinning.

3.3.5 Temperature measurement

The temperature will be detected by a PT 100 temperature sensor.
Two reference resistors 100 ohm = 0°C and 120 ohm = 50°C will give the reference value. The auto-calibration is done by the CPU which controls an analogue switch where the signals will be transferred to a voltage/frequency converter. This select signals to the switch IC will come from the ASIC TEMP_1 and TEMP_2.

3.4 Key and Indication Board

The SEPACONTROL key and indication board is mounted behind the operational panel.
A special microcontroller (P87C51FC) is located on this board controlling the 7 segment displays, the control key LEDs and the operating keys
The communication with the central processor on the main board takes place via serial data lines in both directions (plug **XI**).
The reading of the keys and the displaying of values takes place by multiplex operation. All operational parameters and user programs are stored unlimited in 6 NV-RAMs (type 93C46).
The constant identification No. of the key board processor is **0497** (first displayed No. in speed field). There is a second No. displayed in the time field at the same time. This version No. is subject of the permanently technical outgrowth and will be counted up at any program changes on CPU or parameter changes on NV-RAMs.

3.5 Speed Detection Board

The speed detection takes place opto-electronically through a slit in the motor shaft.
A light-emitting infrared diode and a photo-transistor are mounted on the speed detection board and located on opposing sides of the motor shaft
So 2 trapezoidal pulses per motor revolution are generated and transformed into stable rectangle pulses (Schmitt trigger circuit on board), by which the micro controller calculates the real rotor speed or rcf value.
The speed detection board is connected to the main board via the 3-pin plug **XW**.

3.6 Imbalance switch

If abnormal imbalance of the rotor occurs the imbalance switch will be triggered by the moving motor. The switch closes and this signal will be given to the CPU which detects this as “imbalance”

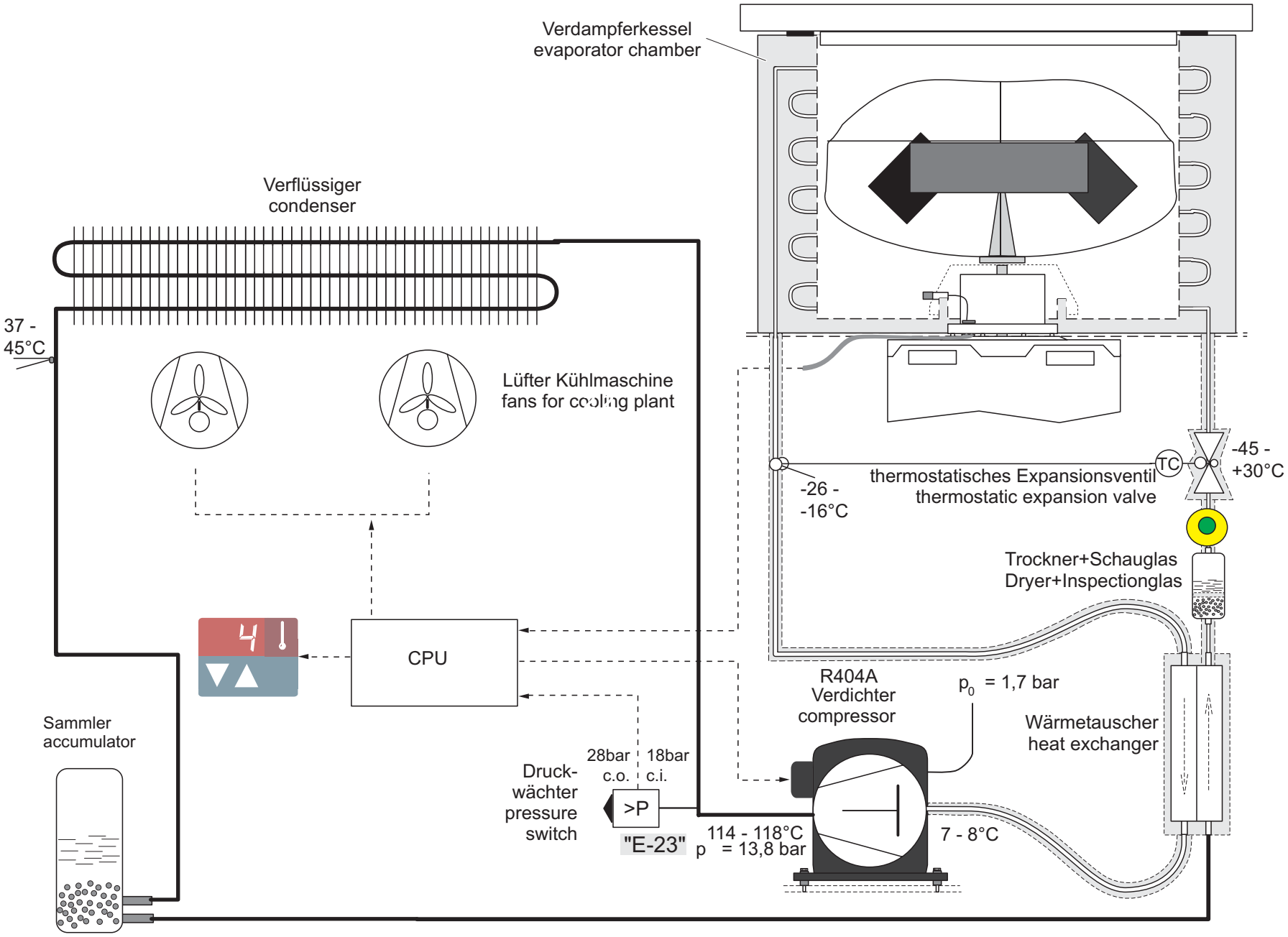
The connection to the switch is made of 4-pole wiring which allows a check of the cable for defect. In this case the imbalance signal will also be displayed.

3.7 Cooling plant

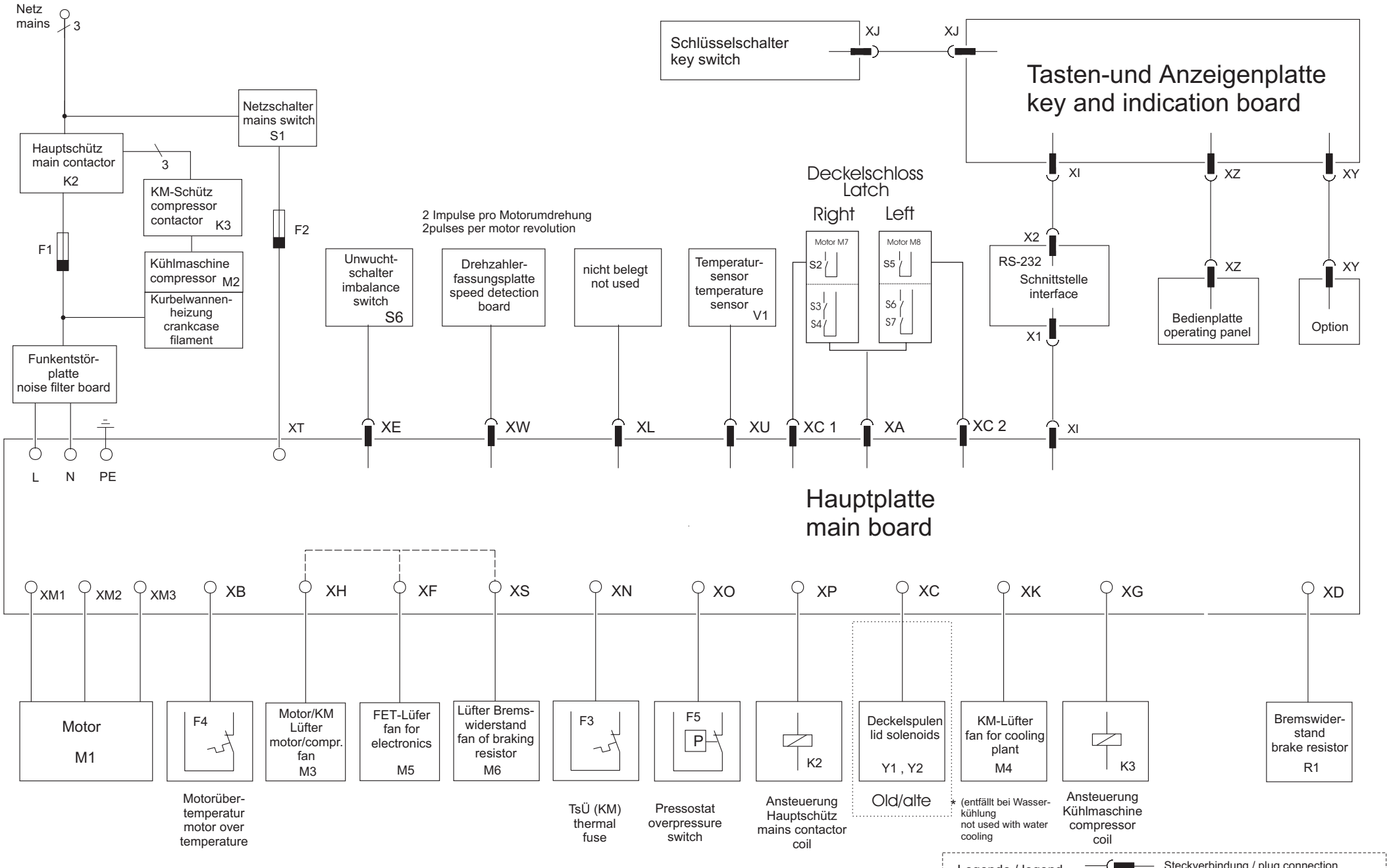
The Cryofuge is equipped with a high-grade cooling plant, to meet it’s requirements of driving power and compact design. The CFC free refrigerant R404A evaporates at low temperatures (≤ -20°C) and absorbs through this the frictional heat from chamber produced by the spinning rotor. Two fans serve for even air flow through condenser so that the refrigerant’s condensing temperature is kept on a low level.

A condenser serves for essential under-cooling of the condensed refrigerant to ensure an optimum evaporation and a perfect operation of the expansion valve. To maintain low evaporation and resultant condensation temperatures on one hand and to support the starting procedure of the compressor on other hand, a thermostatic expansion valve is used.

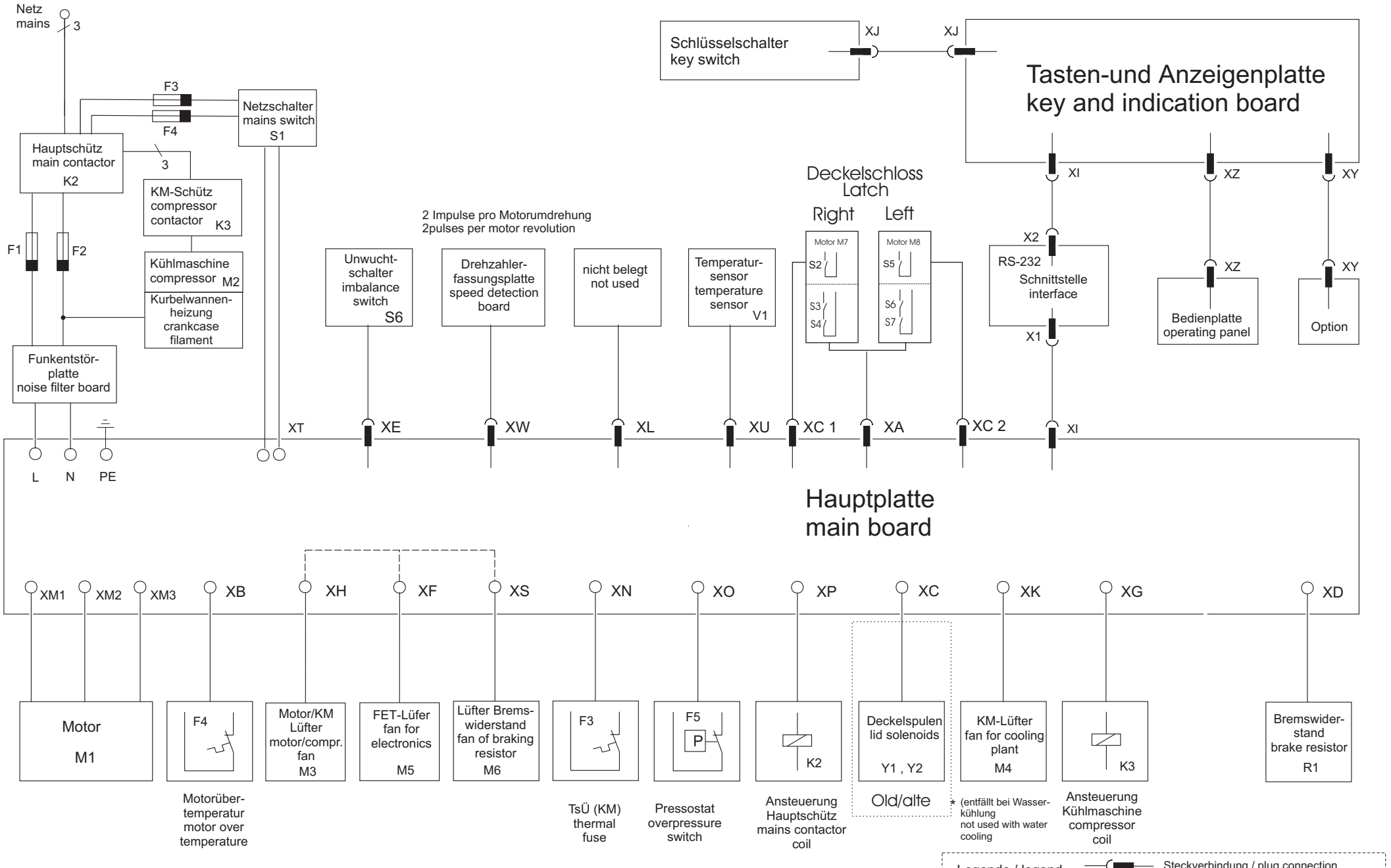
The minimum achievable sample temperatures are depending on speed, rotor type and a little on ambient temperature. After a compensating time (at max speed – 3 hours) as optimal result, the rotor has reached the selected set temperature within a tolerance of ± 2K.



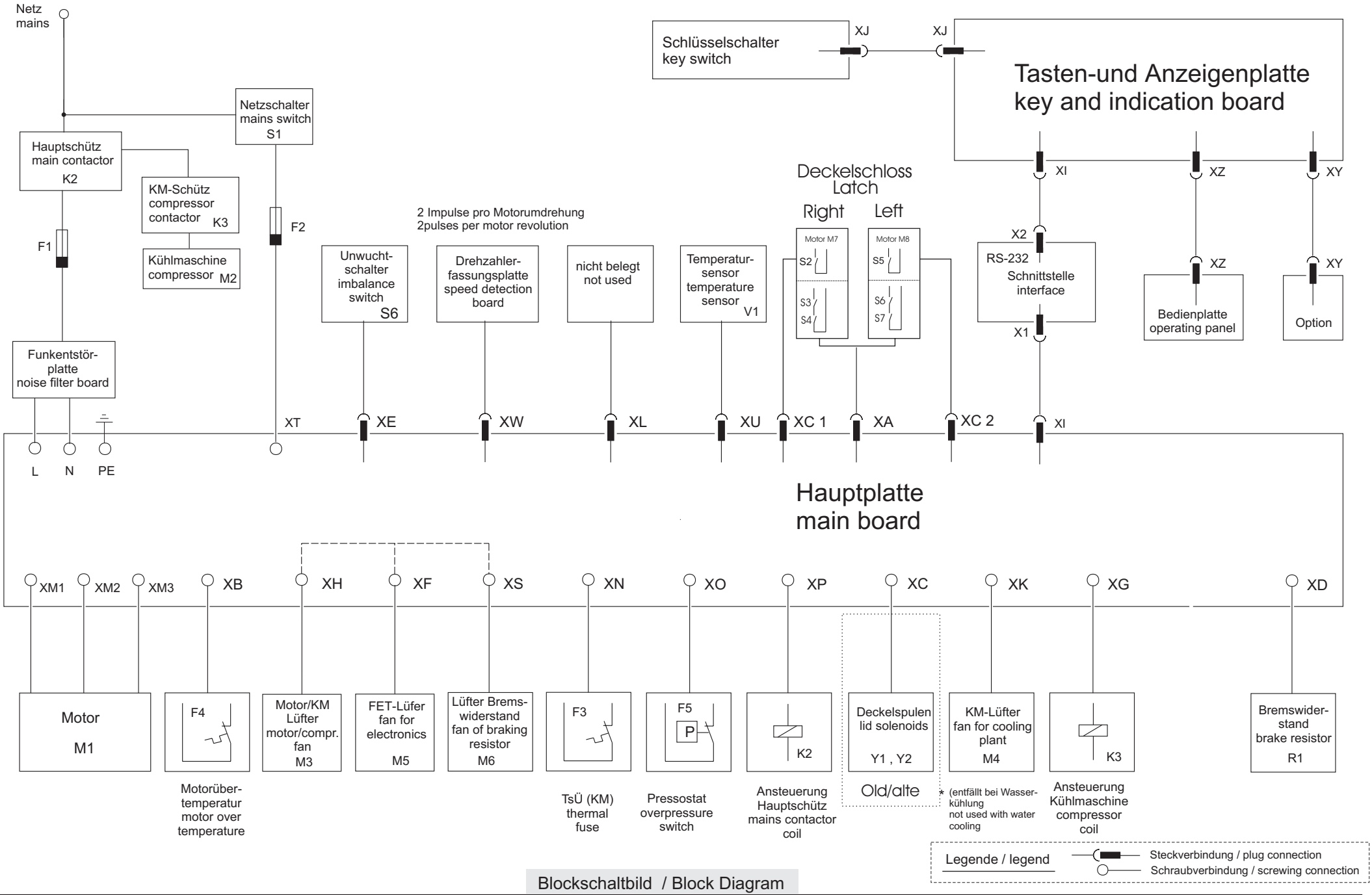
Fließbild / Flowchart



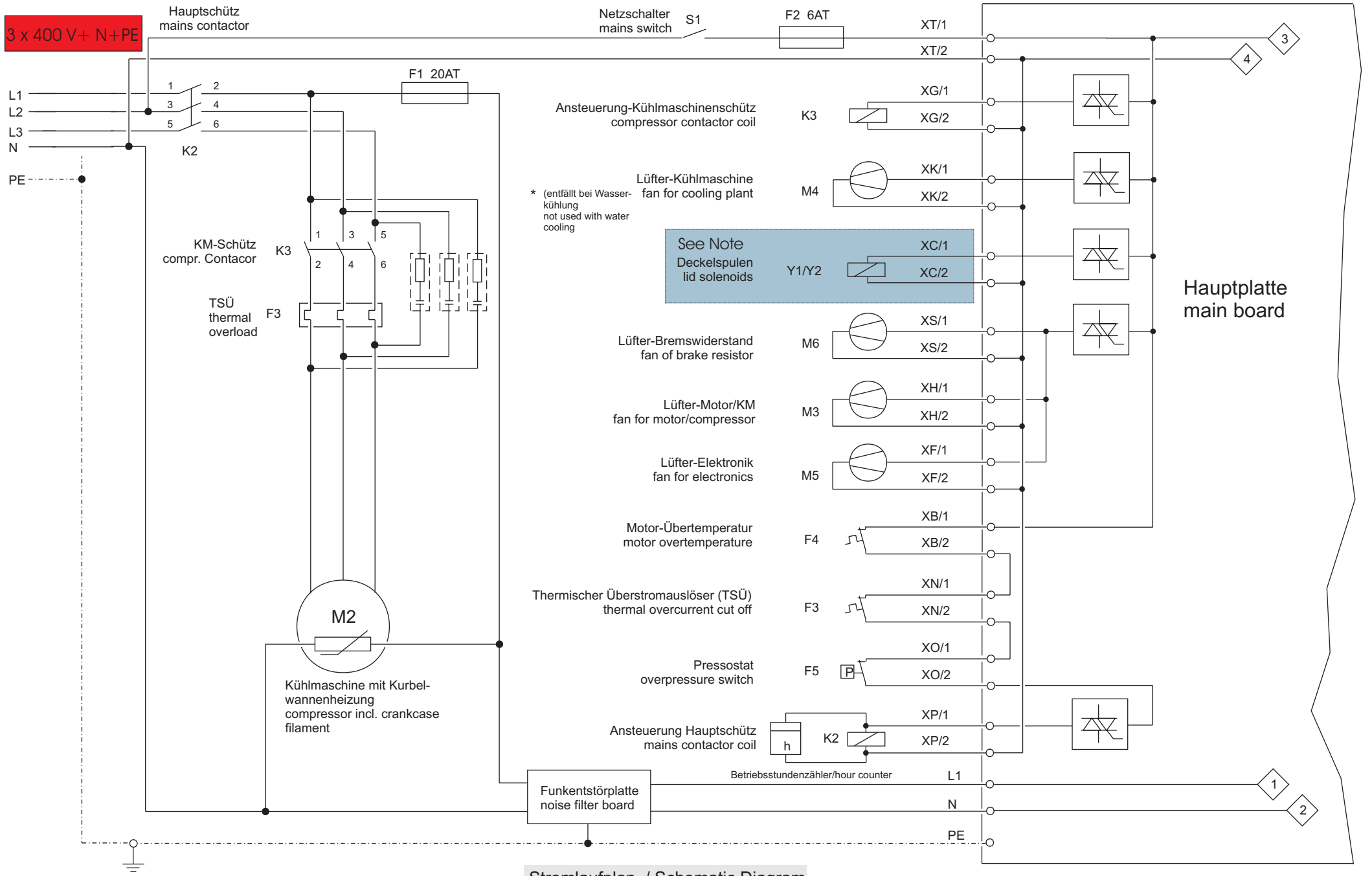
Blockschaltbild / Block Diagram



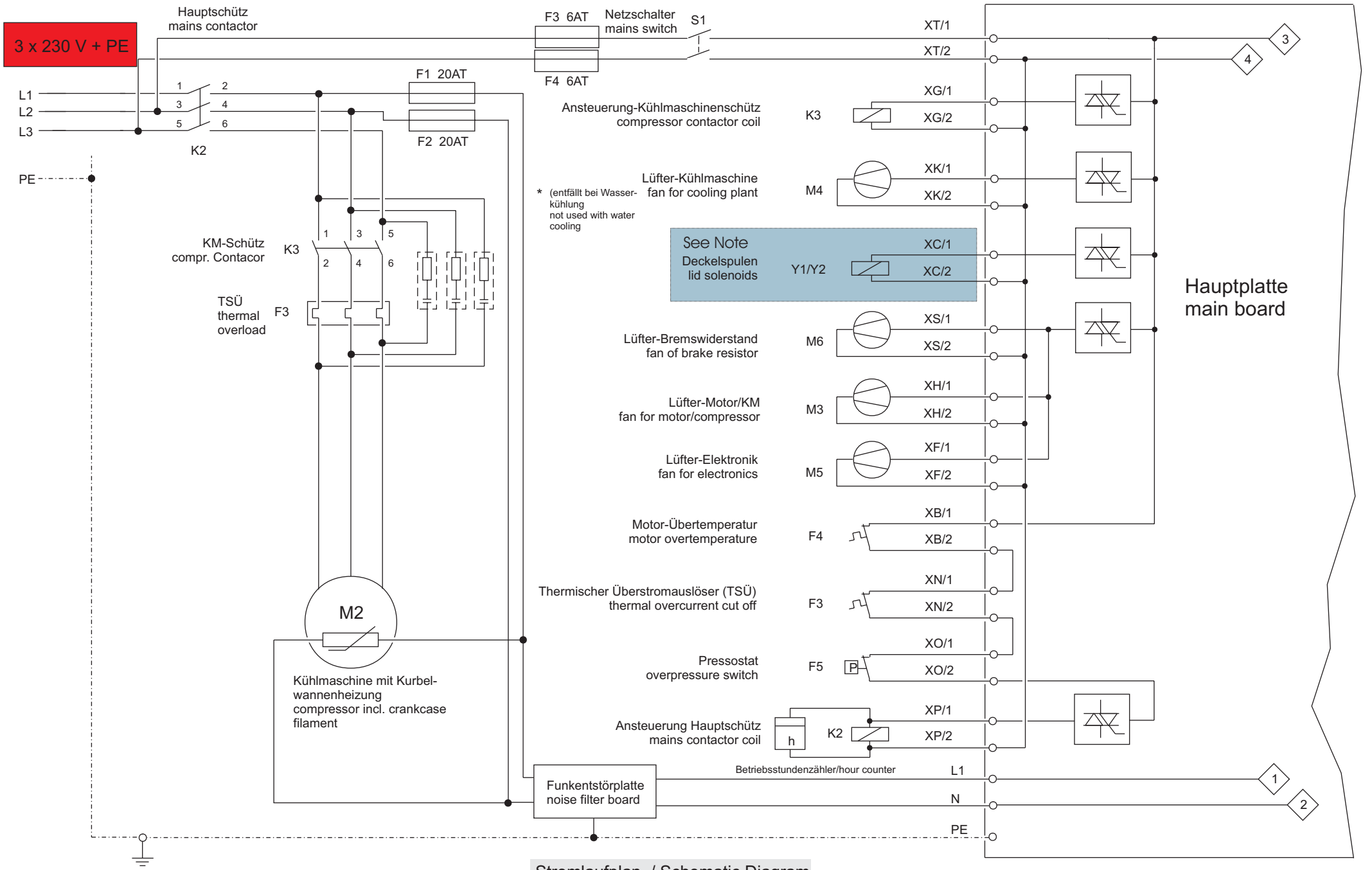
Blockschaltbild / Block Diagram



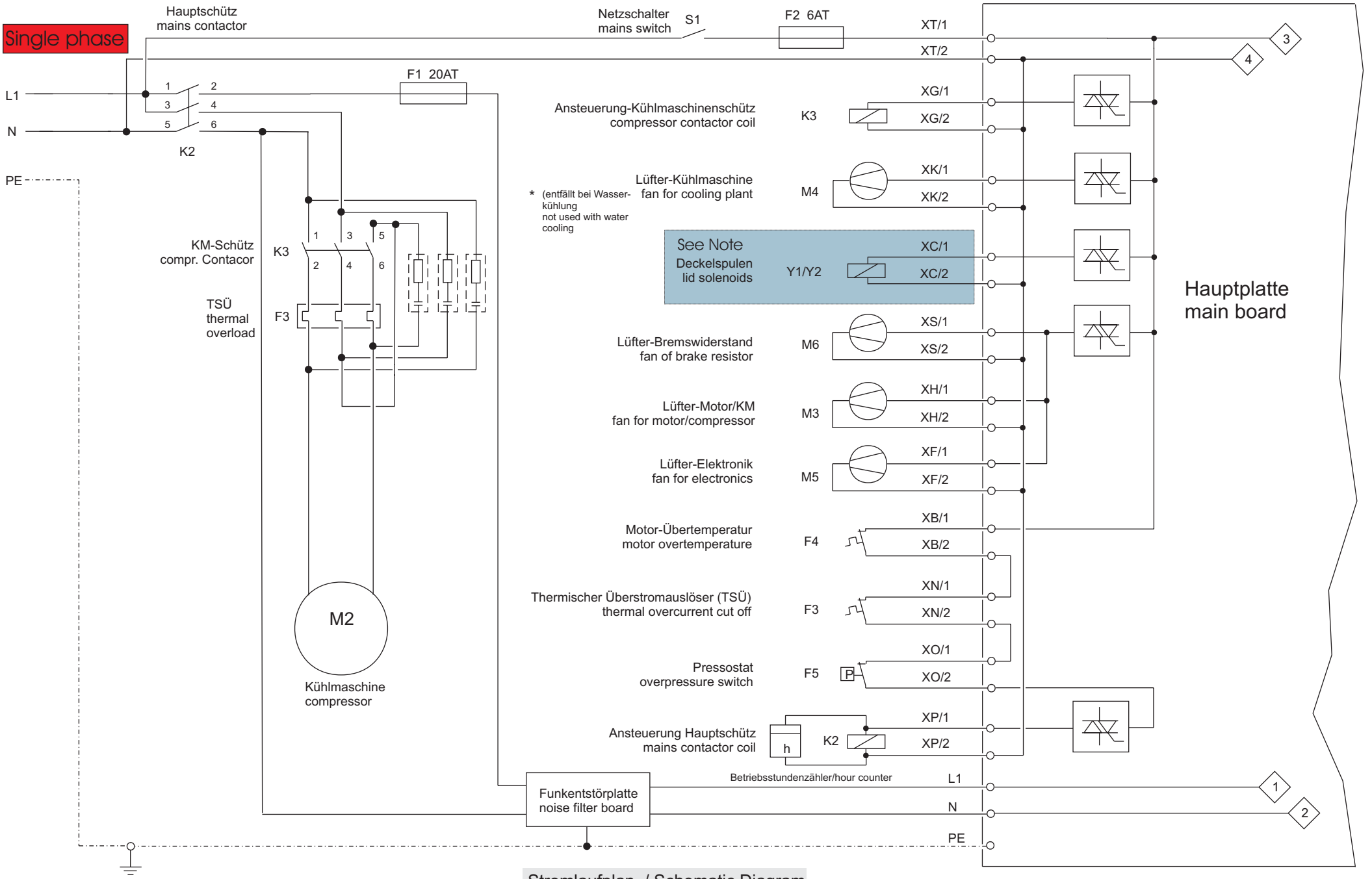
Blockschaltbild / Block Diagram



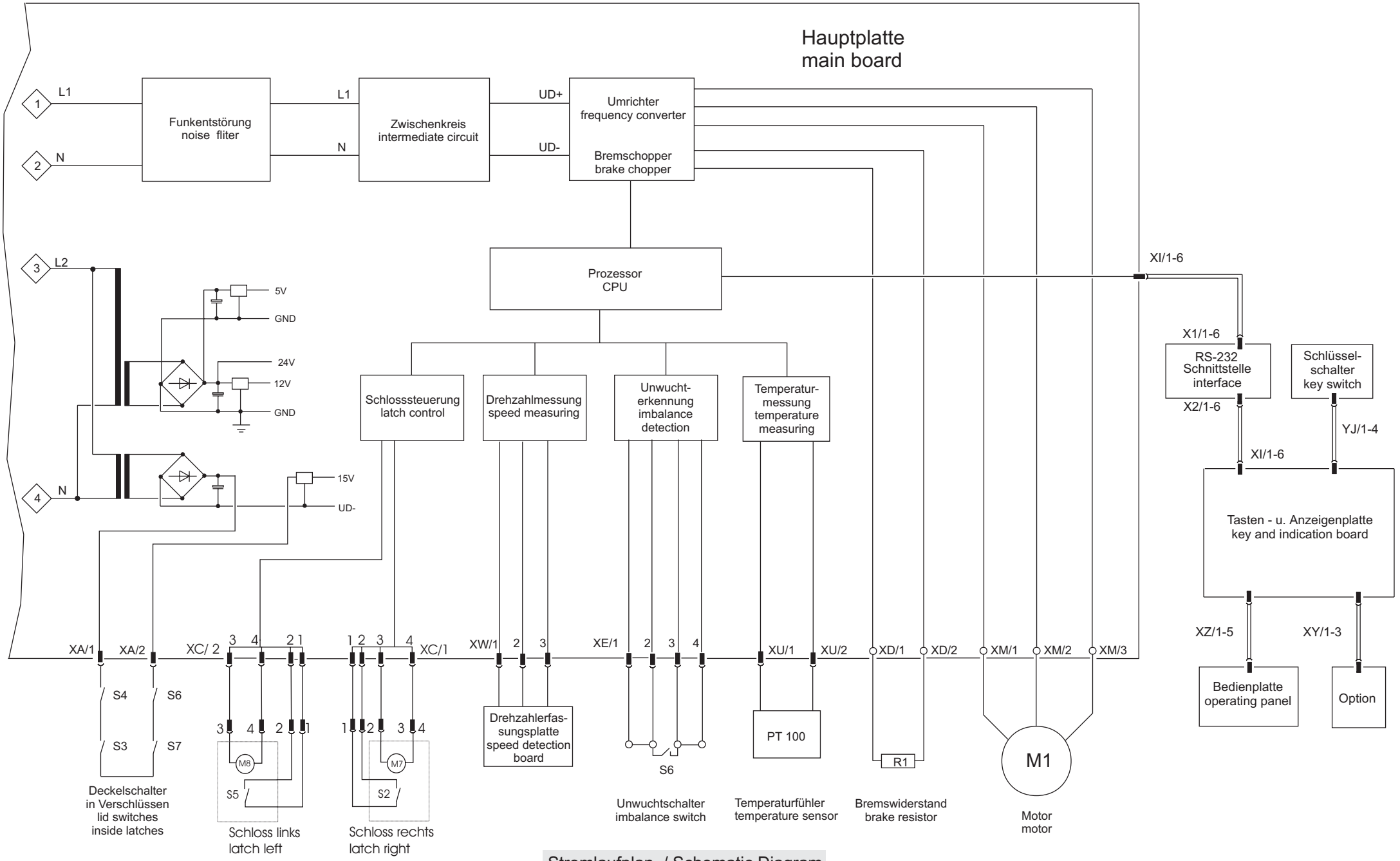
Stromlaufplan / Schematic Diagram



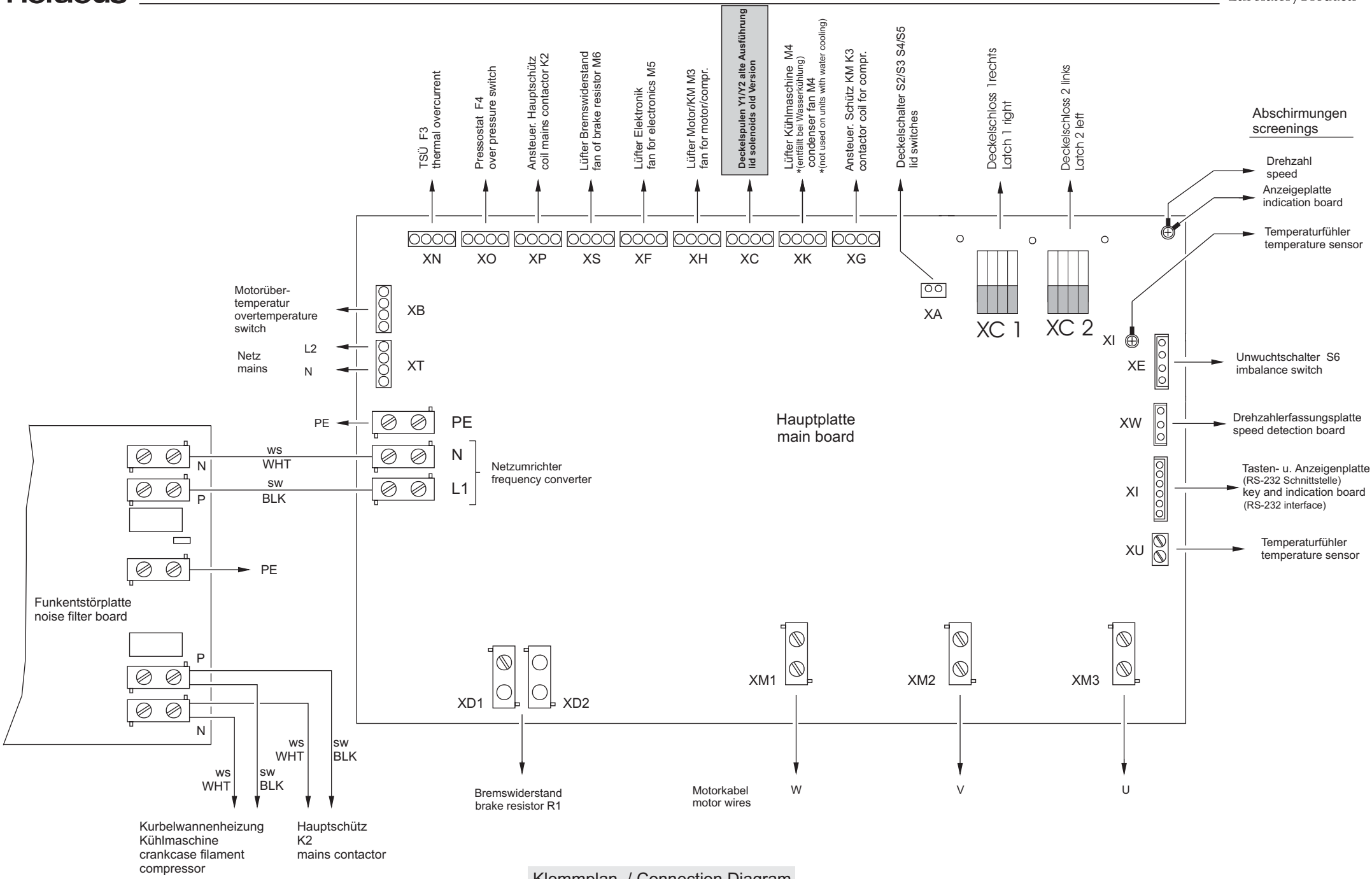
Stromlaufplan / Schematic Diagram



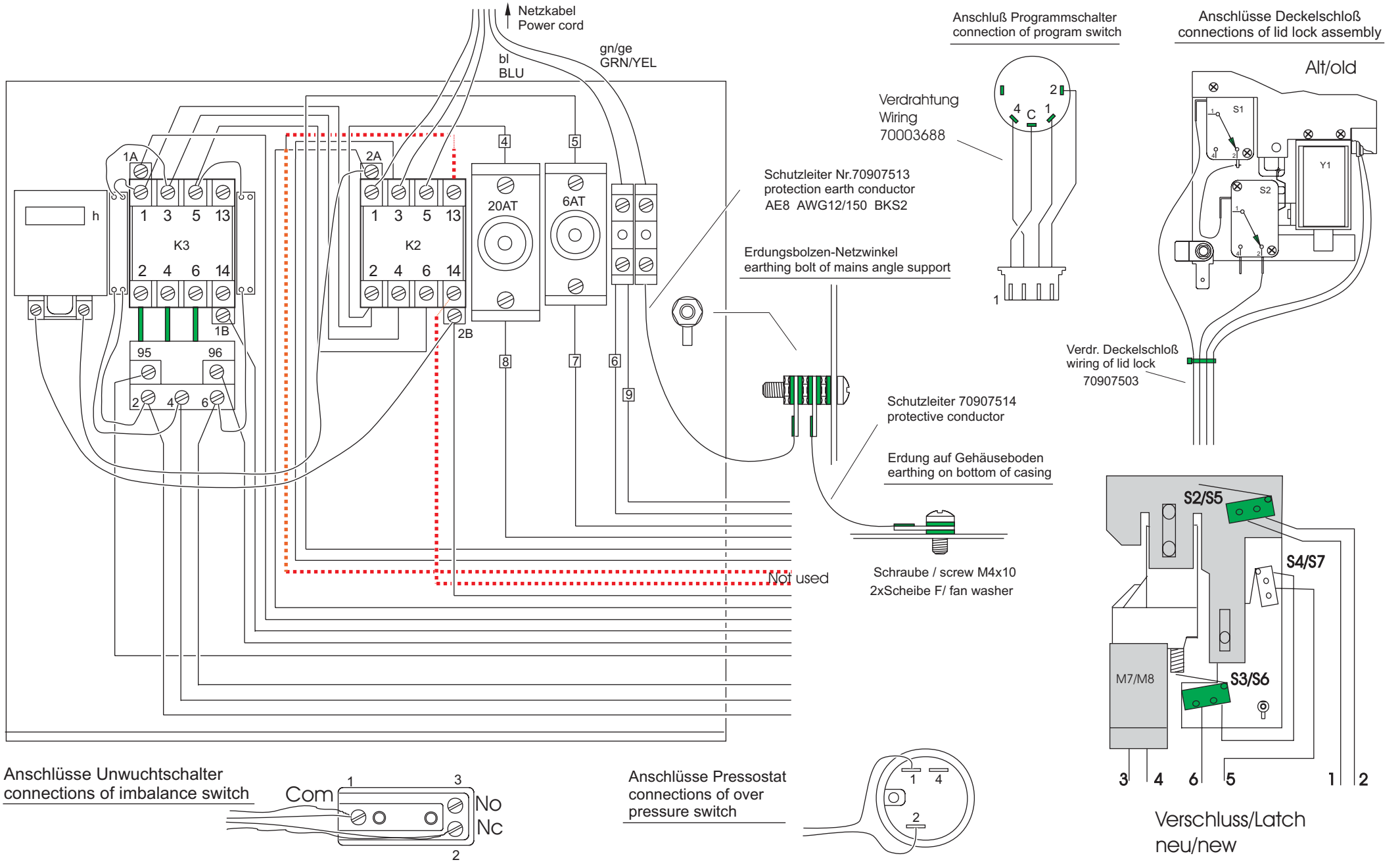
Stromlaufplan / Schematic Diagram



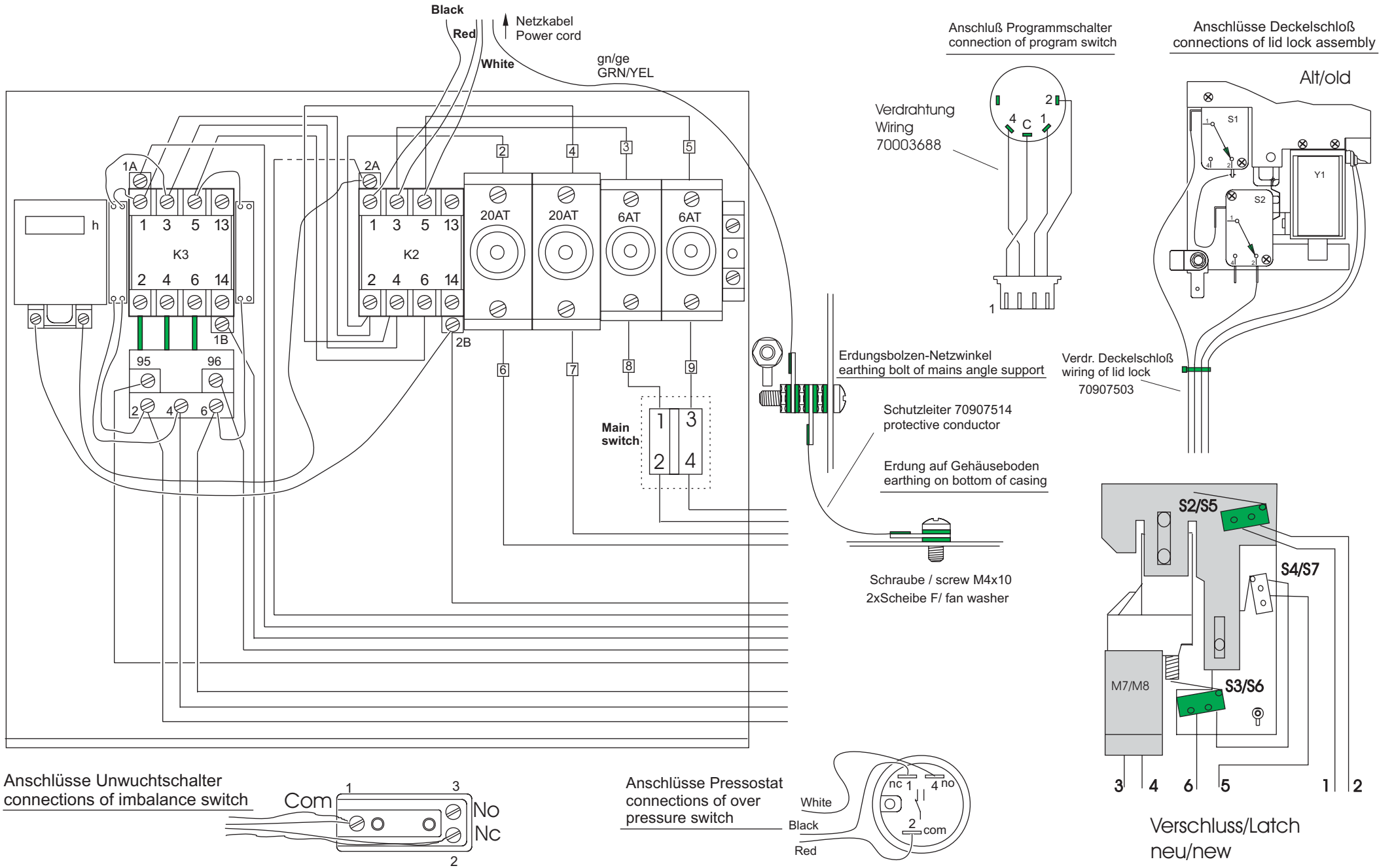
Stromlaufplan / Schematic Diagram



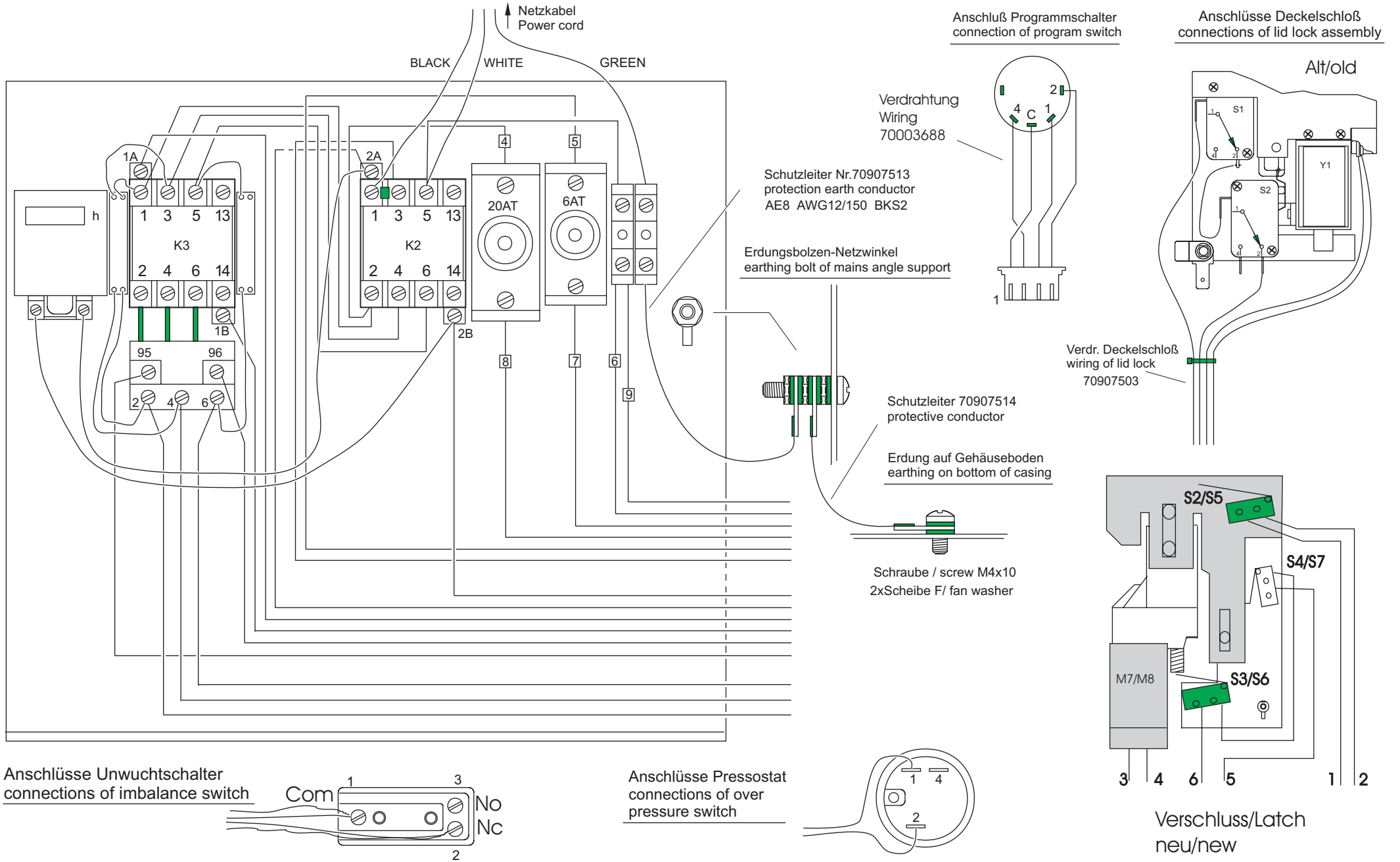
Klemmplan / Connection Diagram



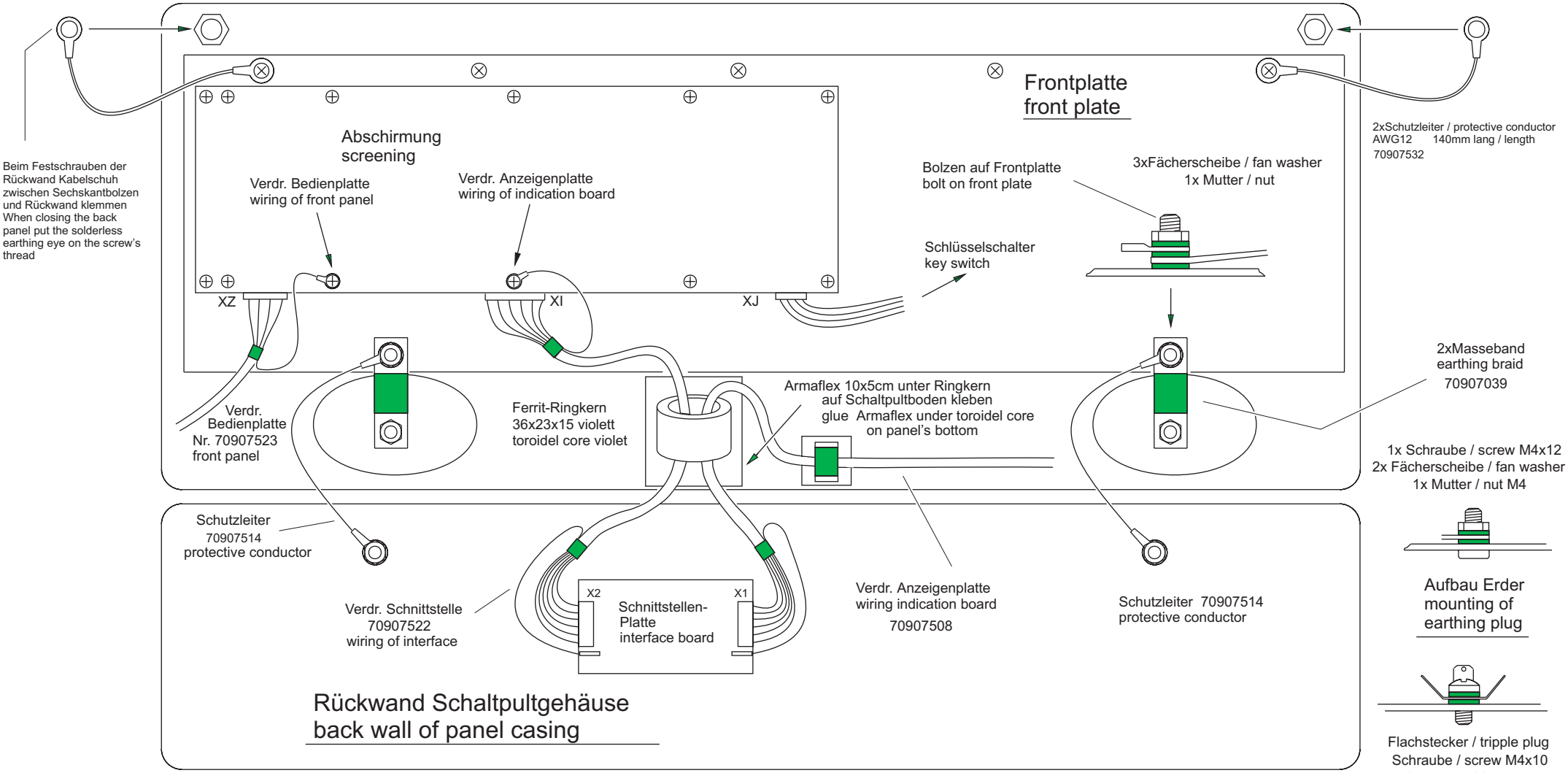
Klemmplan / Connection Diagram



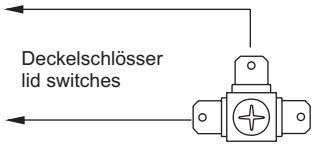
Klemmplan / Connection Diagram



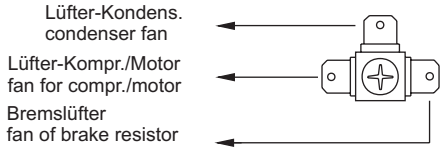
Klemmplan / Connection Diagram

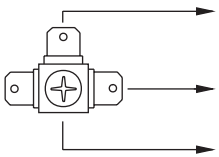


Schutzleiteranschlüsse
connections of protective conductors



*(entfällt bei Wasserkühlung)
*(not used on units with water cooling)



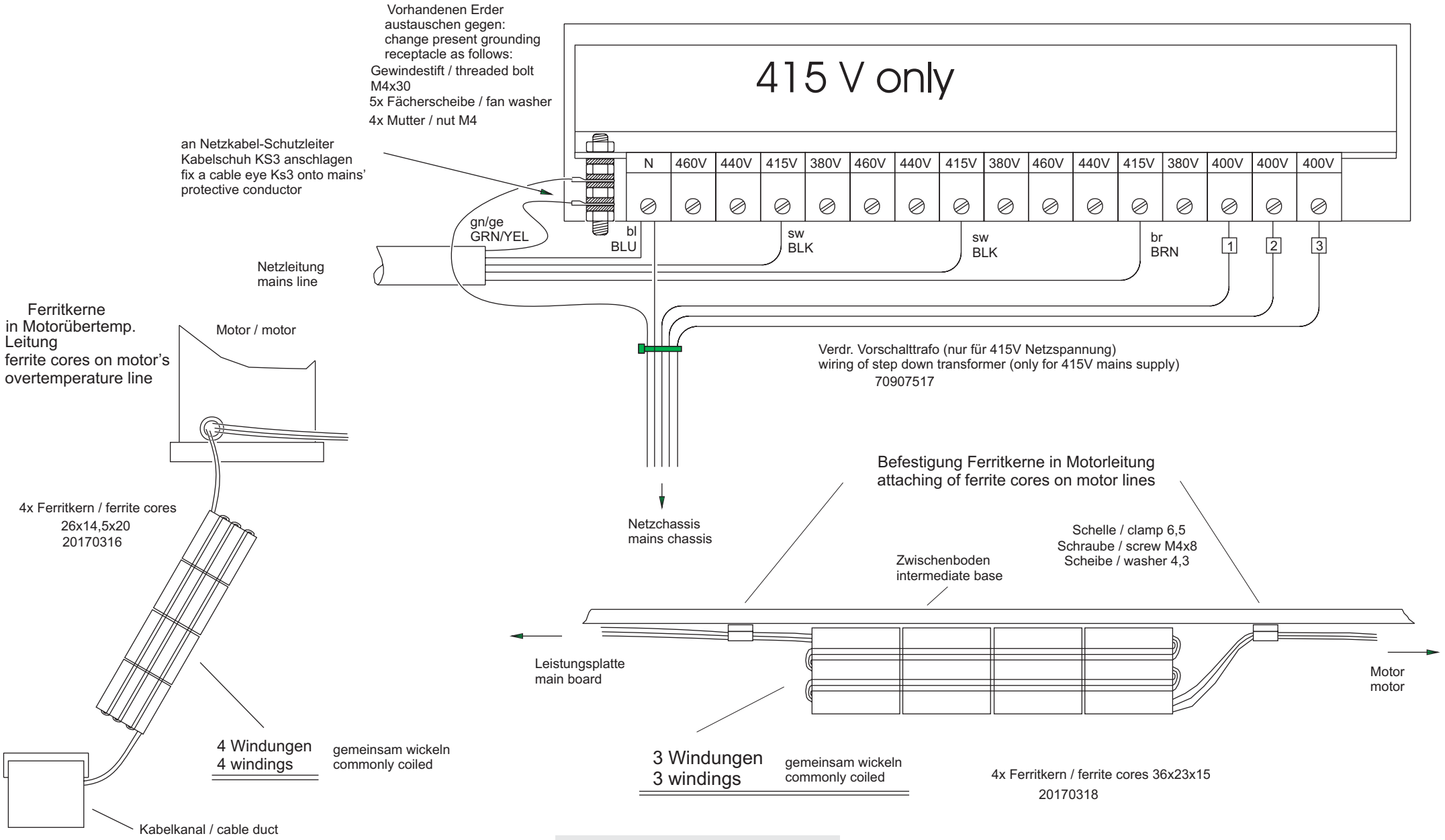


Schutzleiter
protective conductors

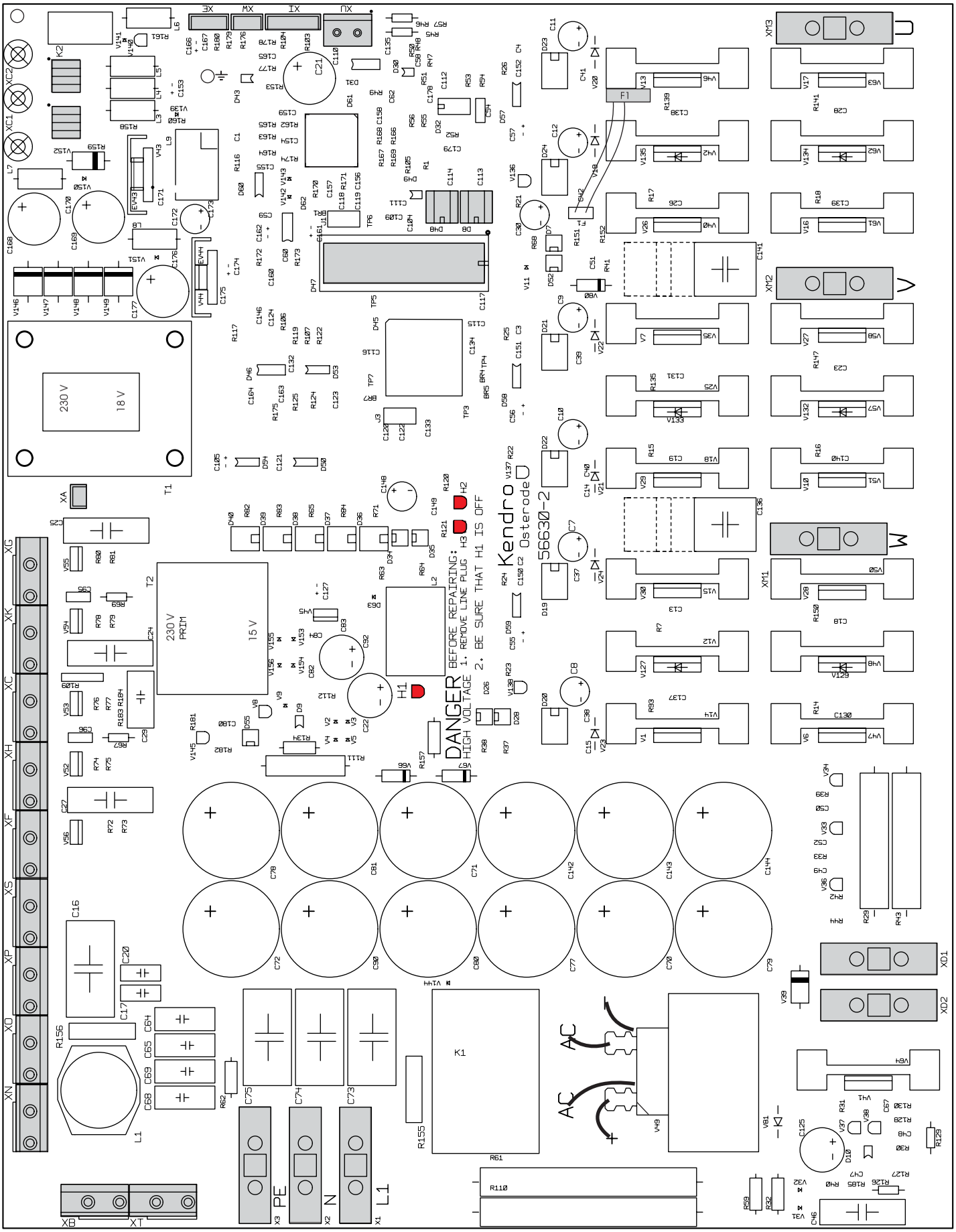
Tür-Gehäuse front door	70907514
Kühlmaschine compressor	70004984
Rückwand back wall	70004891

Klemmplan / Connection Diagram

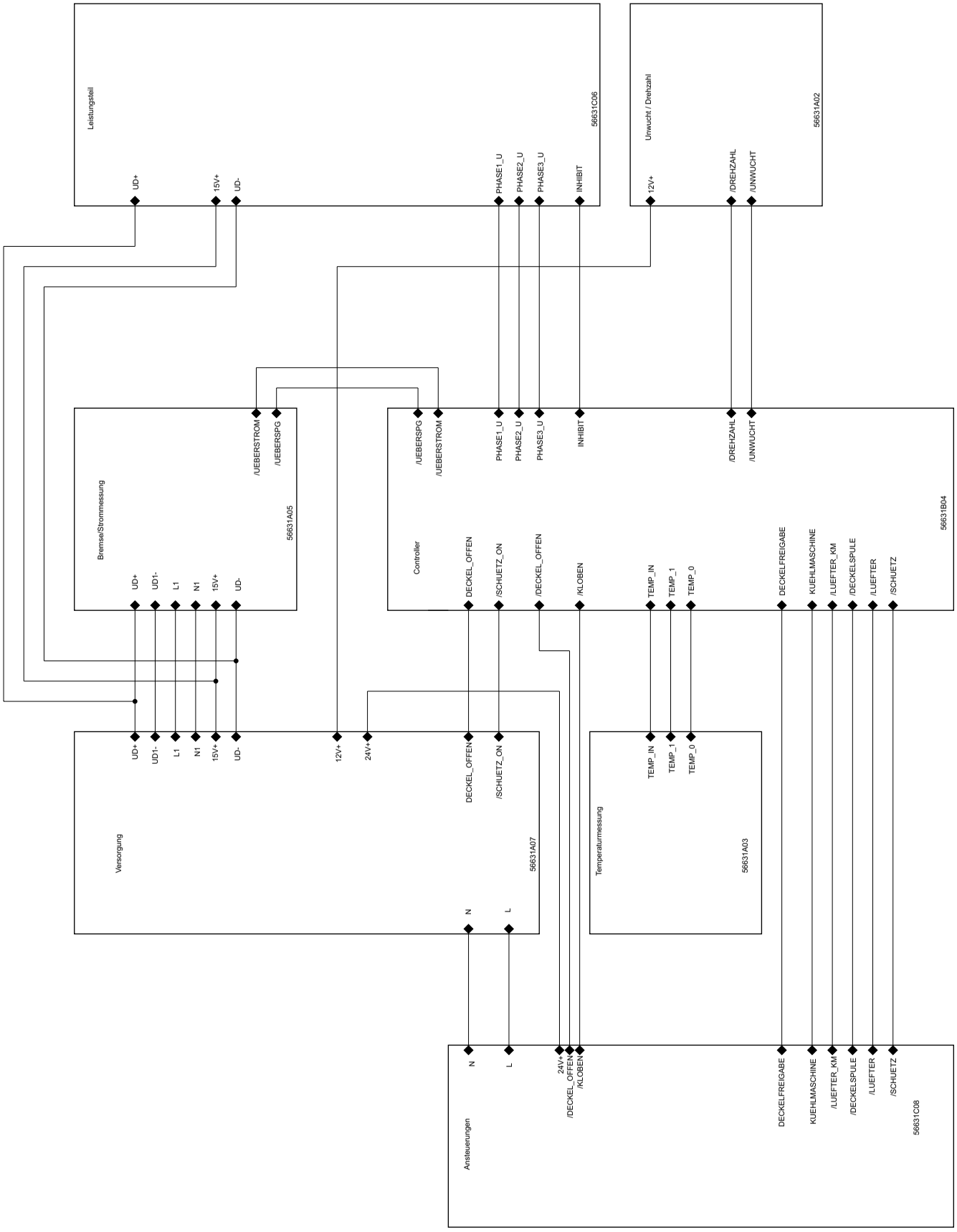
Klemmplan Vorschalttrafo
Connection Diagram for Step Down Transformer



Klemmplan / Connection Diagram

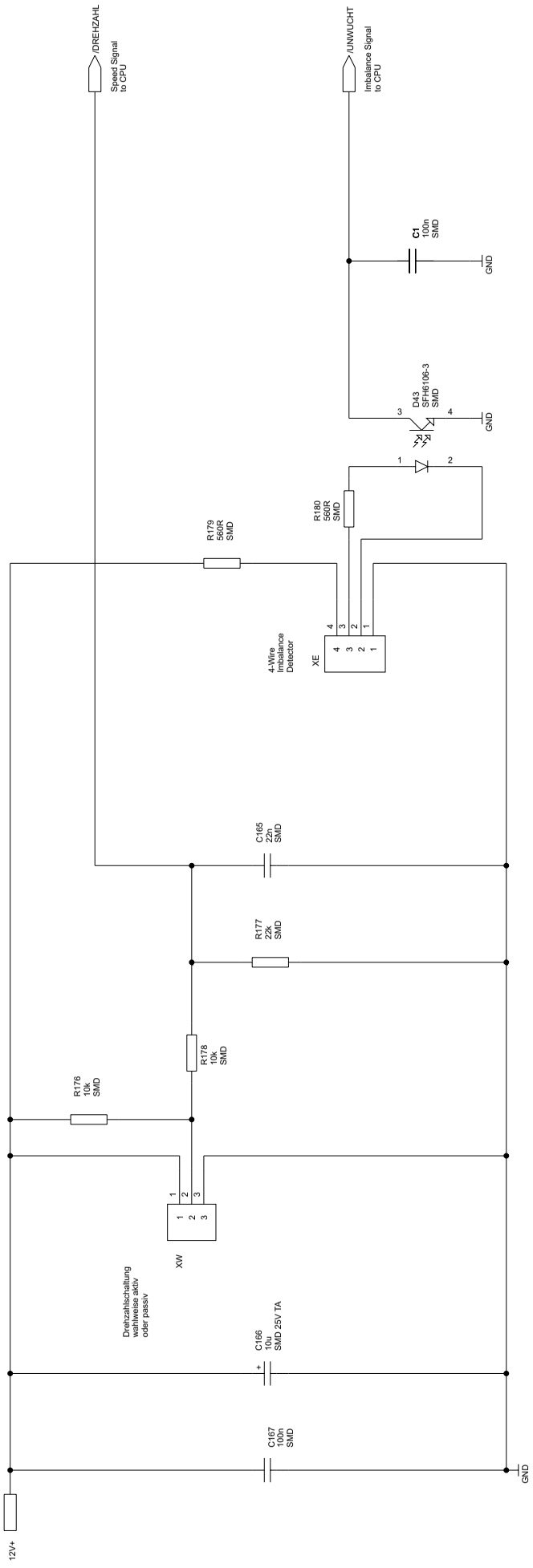


Bestückungsplan Hauptplatte / Component Plan mainboard

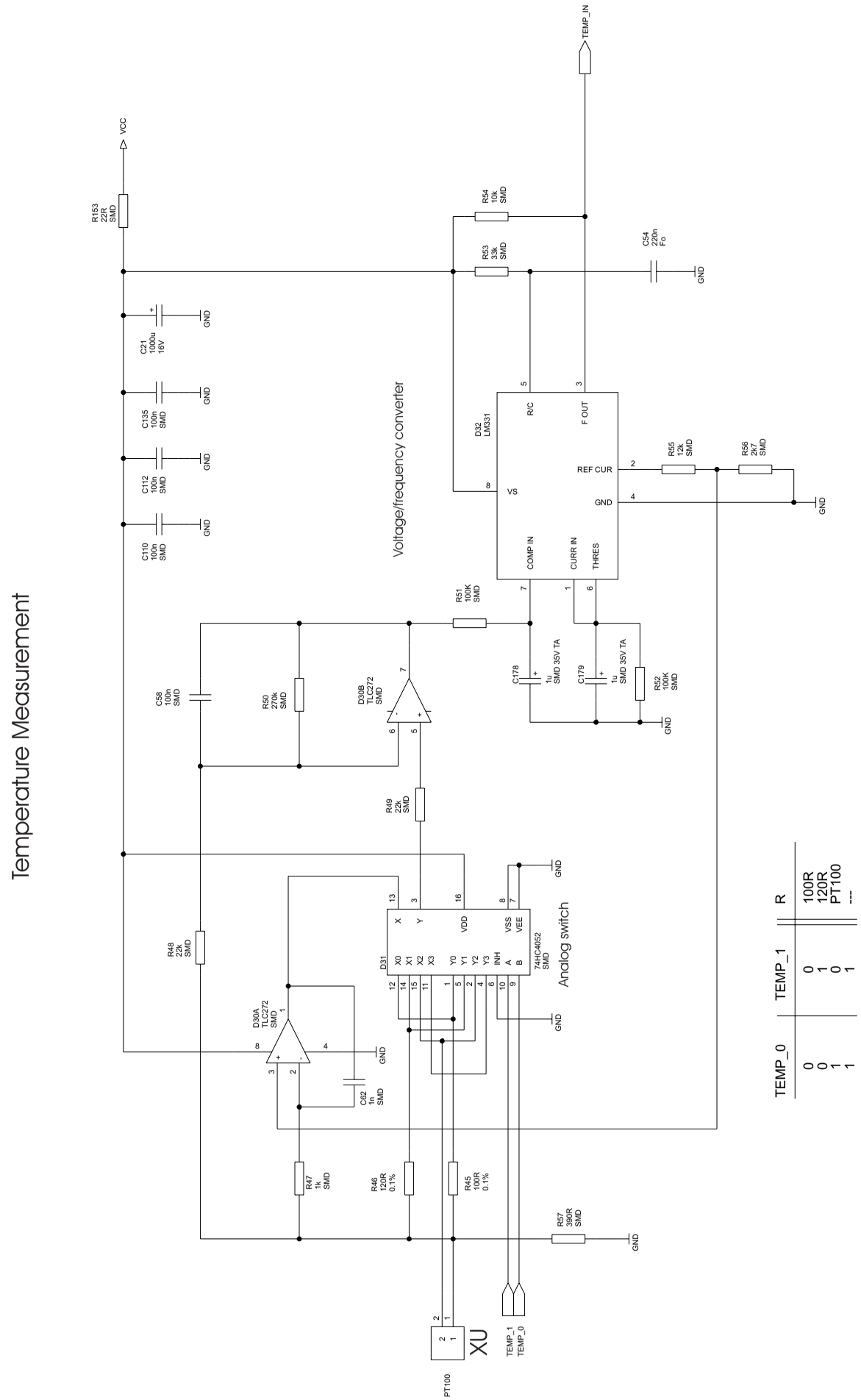


Schaltbild Hauptplatte / Wiring Diagram mainboard

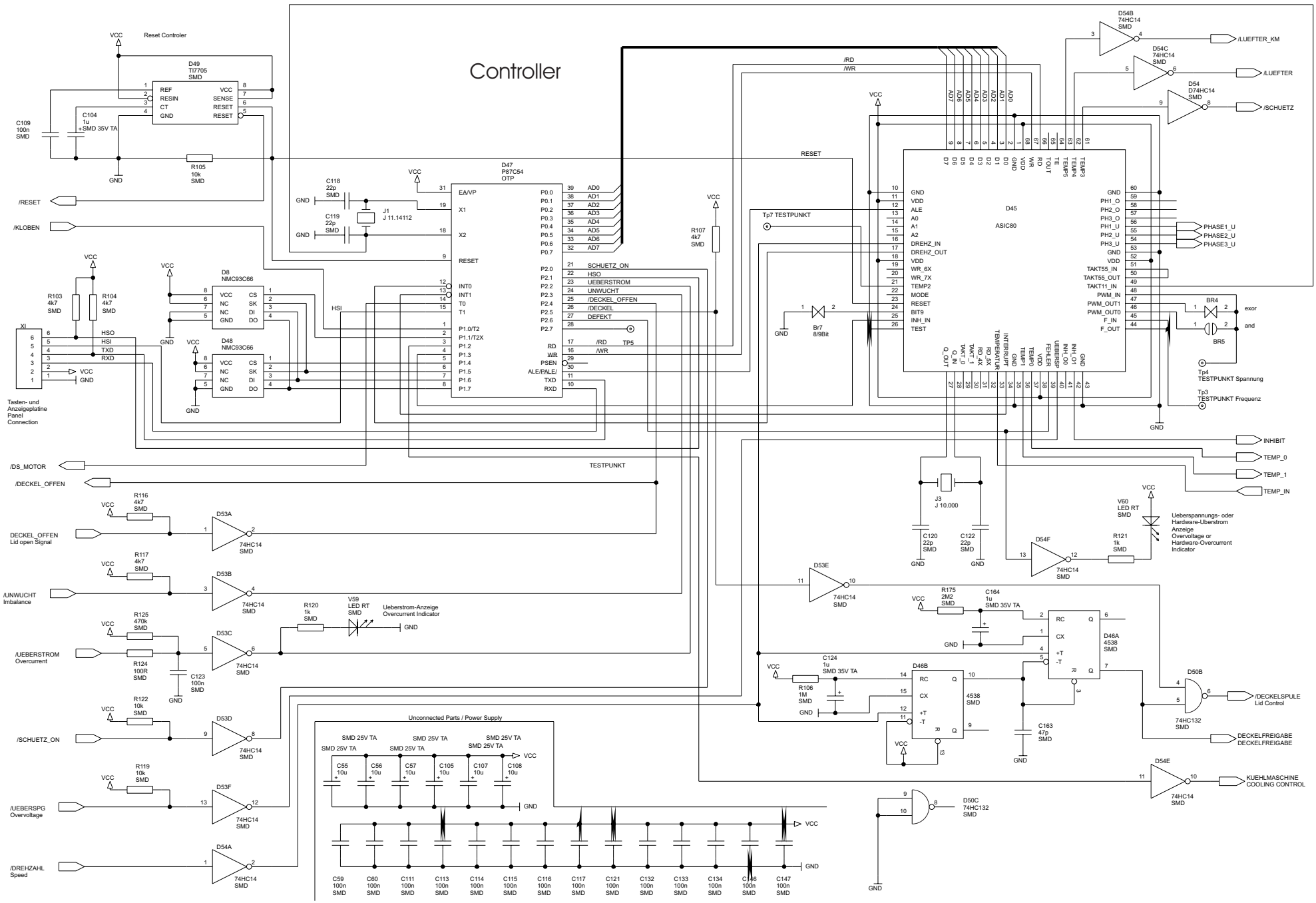
Tachogenerator and Imbalance

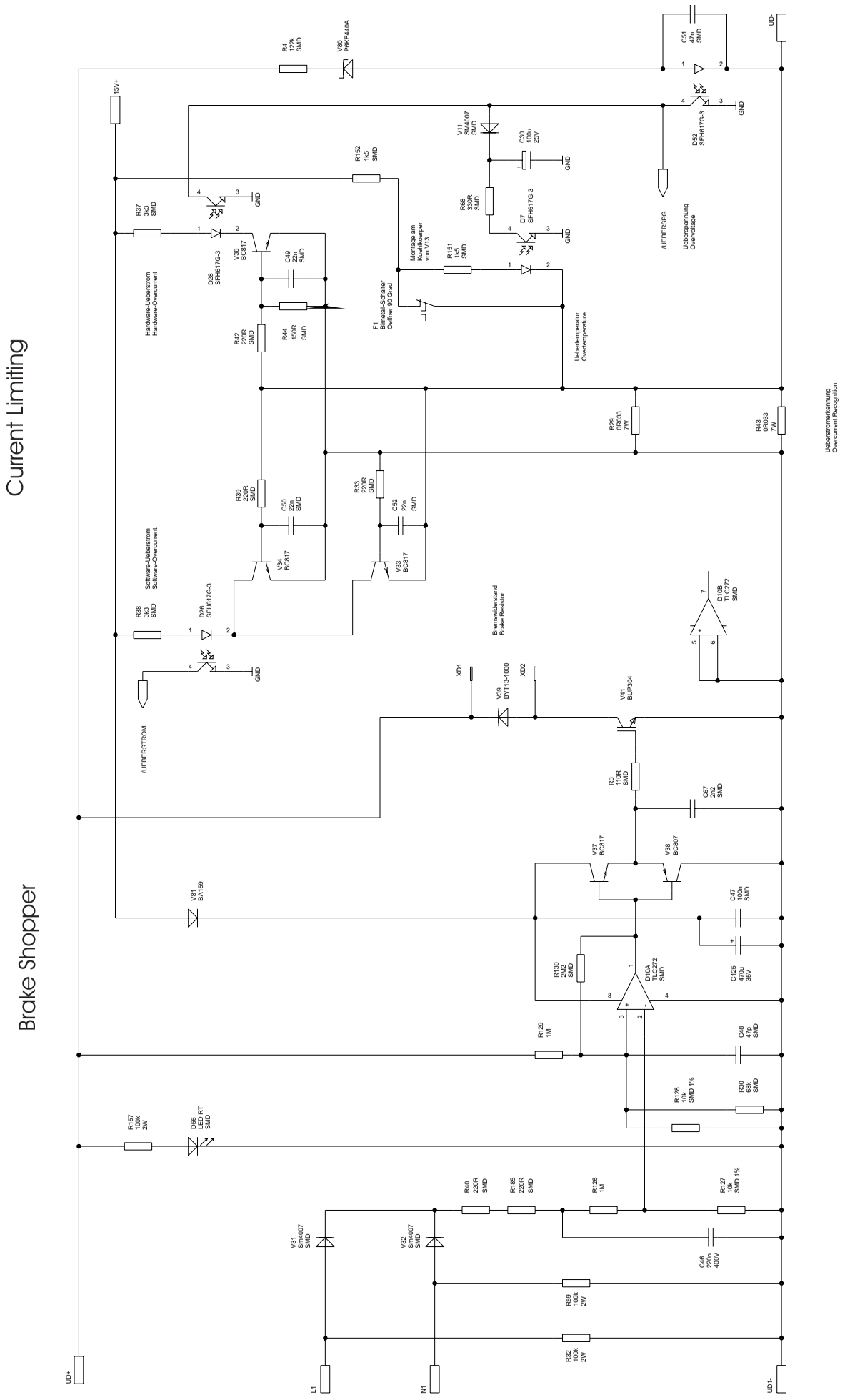


Schaltbild Hauptplatte / Wiring Diagram mainboard

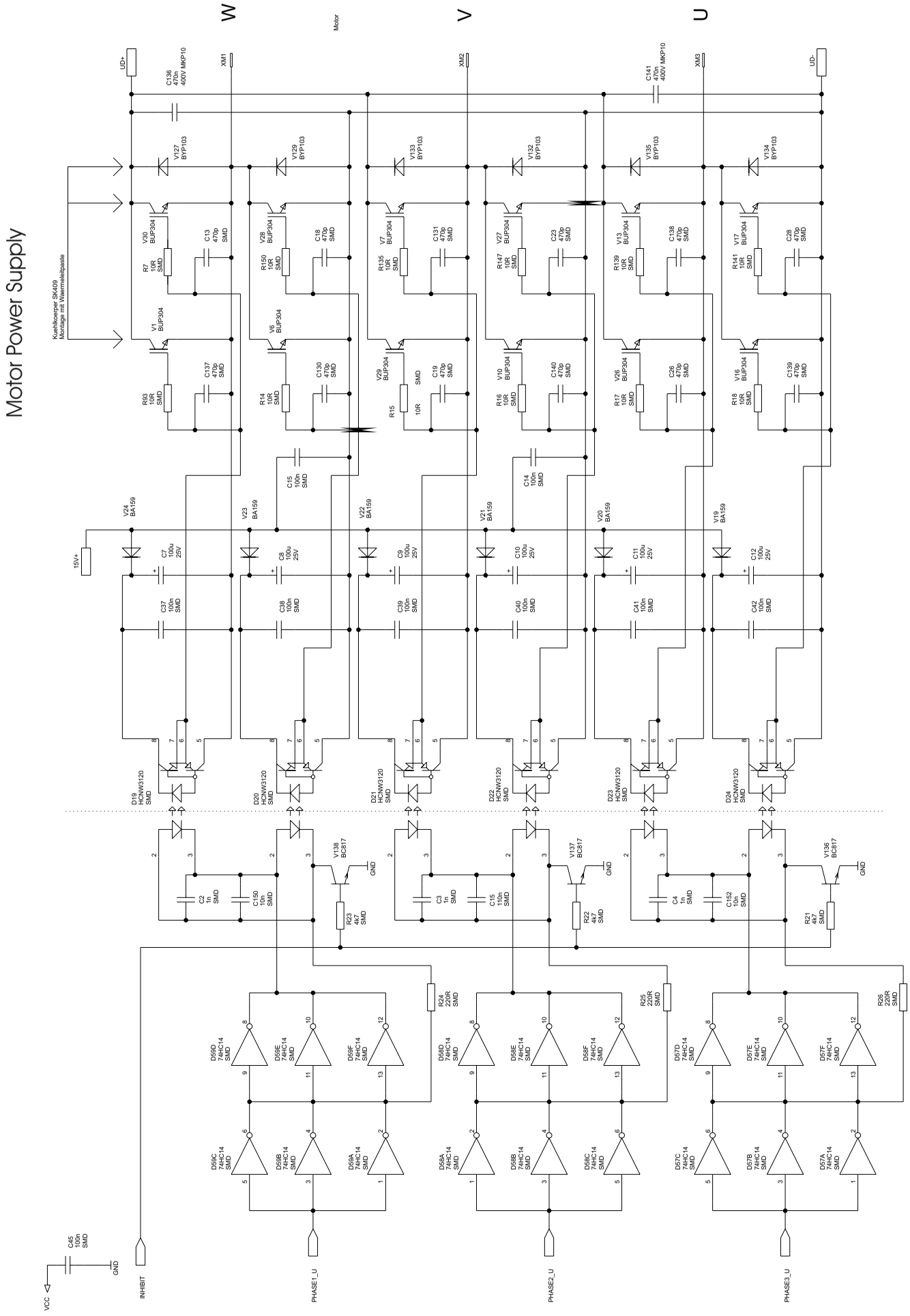


Schaltbild Hauptplatte / Wiring Diagram mainboard


Controller
Reset Controler
D49 TI7705 SMD
REF
RESIN
CT
GND
VCC
SENSE
RESET
C109 100n SMD
C104 1u +SMD 35V TA
R105 10k SMD
/RESET
/KLOBEN
D47 P87C54 OTP
EA/VP
X1
X2
RESET
INT0
INT1
T0
T1
P1.0/T2
P1.1/T2X
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
P0.7
P2.0
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
RD
WR
PSEN
ALE/PALE/
TXD
RXD
AD0
AD1
AD2
AD3
AD4
AD5
AD6
AD7
SCHUETZ_ON
HSO
UEBERSTROM
UNWUCHT
/DECKEL_OFFEN
/DECKEL
DEFEKT
/RD
/WR
TP5
C118 22p SMD
C119 22p SMD
J1 J 11.14112
R107 4k7 SMD
Tp7 TESTPUNKT
Br7 8/9Bit
D45 ASIC80
GND
VDD
ALE
A0
A1
A2
DREHZ_IN
DREHZ_OUT
MODE
RESET
BIT9
INH_IN
TEST
WR_6X
WR_7X
TEMP2
PHASE1_U
PHASE2_U
PHASE3_U
TAKT55_IN
TAKT55_OUT
TAKT11_IN
PWM_IN
PWM_OUT1
PWM_OUT0
F_IN
F_OUT
BR4
exor
BR5
and
Tp4 TESTPUNKT Spannung
Tp3 TESTPUNKT Frequenz
D8 NMC93C66
D48 NMC93C66
VCC
NC
SK
DI
DO
CS
R103 4k7 SMD
R104 4k7 SMD
HSI
XI
HSO
TXD
RXD
Tasten- und Anzeigeplatine Panel Connection
D54B 74HC14 SMD
D54C 74HC14 SMD
D54 D74HC14 SMD
/LUEFTER_KM
/LUEFTER
/SCHUETZ
INHIBIT
TEMP_0
TEMP_1
TEMP_IN
/DS_MOTOR
/DECKEL_OFFEN
TESTPUNKT
DECKEL_OFFEN Lid open Signal
/UNWUCHT Imbalance
/UEBERSTROM Overcurrent
/SCHUETZ_ON
/UEBERSPG Overvoltage
/DREHZAHL Speed
R116 4k7 SMD
R117 4k7 SMD
R125 470k SMD
R124 100R SMD
C123 100n SMD
R122 10k SMD
R119 10k SMD
D53A
D53B
D53C
D53D
D53F
D54A
74HC14 SMD
R120 1k SMD
V59 LED RT SMD
Ueberstrom-Anzeige Overcurrent Indicator
J3 J 10.000
C120 22p SMD
C122 22p SMD
D54F
D53E
V60 LED RT SMD
R121 1k SMD
Ueberspannungs- oder Hardware-Uberstrom Anzeige Overvoltage or Hardware-Overcurrent Indicator
R175 2M2 SMD
C164 1u SMD 35V TA
D46A 4538 SMD
C124 1u SMD 35V TA
R106 1M SMD
D46B 4538 SMD
C163 47p SMD
D50B 74HC132 SMD
/DECKELSPULE Lid Control
DECKELFREIGABE
D54E
KUEHLMASCHINE COOLING CONTROL
D50C 74HC132 SMD
Unconnected Parts / Power Supply
SMD 25V TA
C55 10u
C56 10u
C57 10u
C105 10u
C107 10u
C108 10u
C59 100n SMD
C60 100n SMD
C111 100n SMD
C113 100n SMD
C114 100n SMD
C115 100n SMD
C116 100n SMD
C117 100n SMD
C121 100n SMD
C132 100n SMD
C133 100n SMD
C134 100n SMD
C146 100n SMD
C147 100n SMD



Schaltbild Hauptplatte / Wiring Diagram mainboard

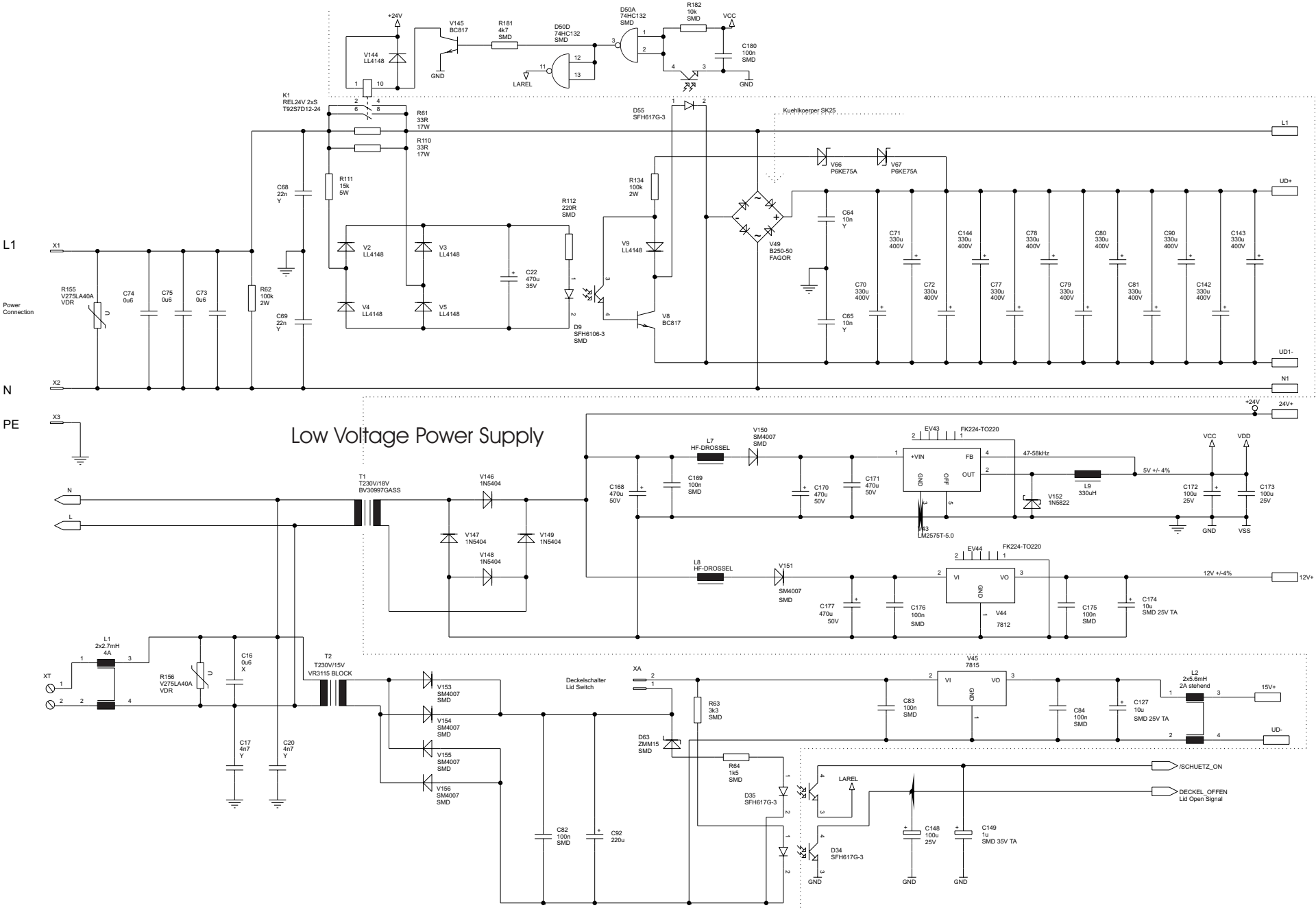


Schaltbild Hauptplatte / Wiring Diagram mainboard

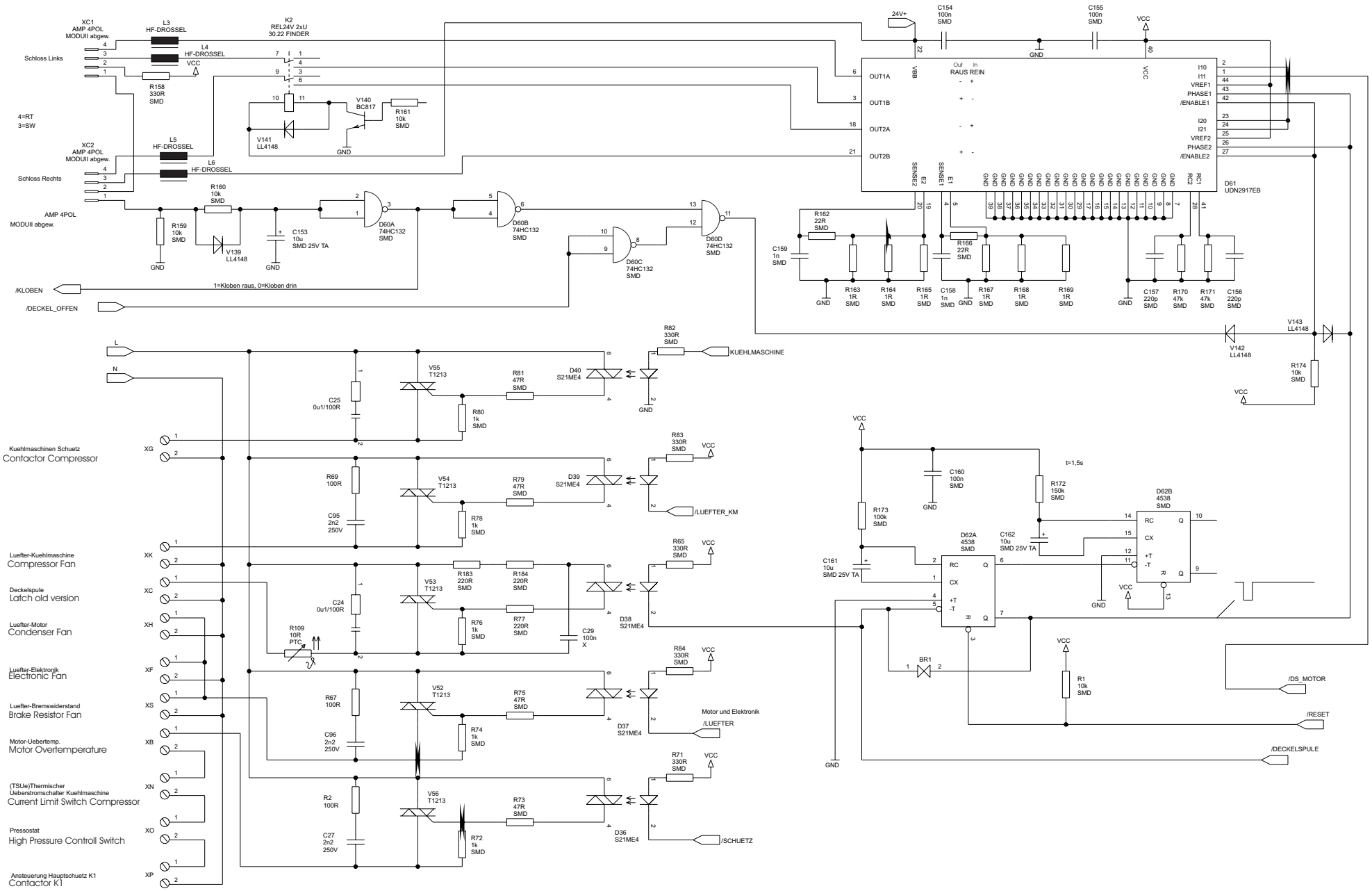
CAP Pre-Charging

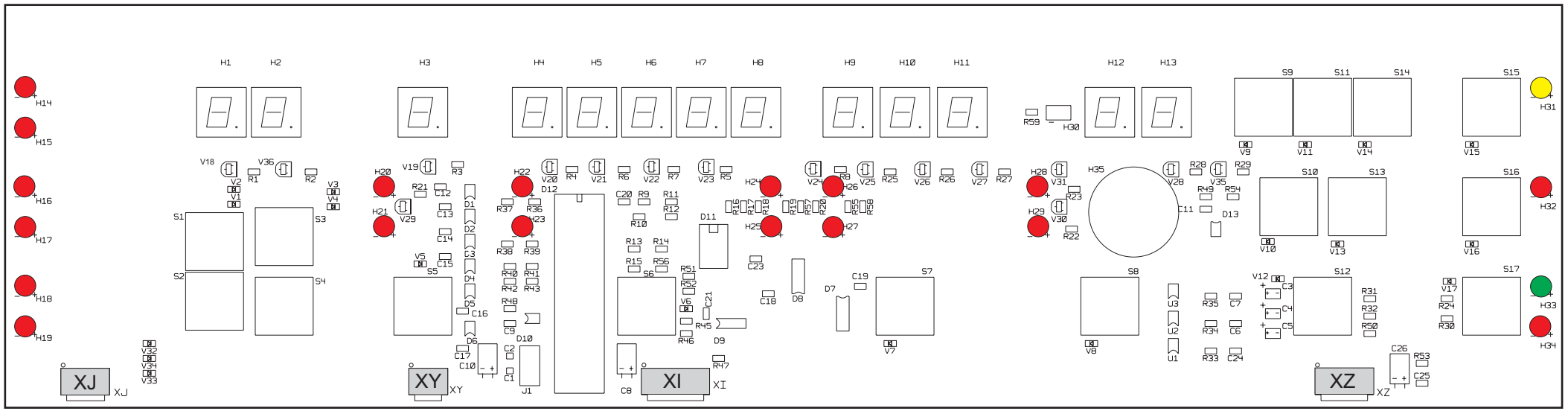
High Voltage DC Power Supply

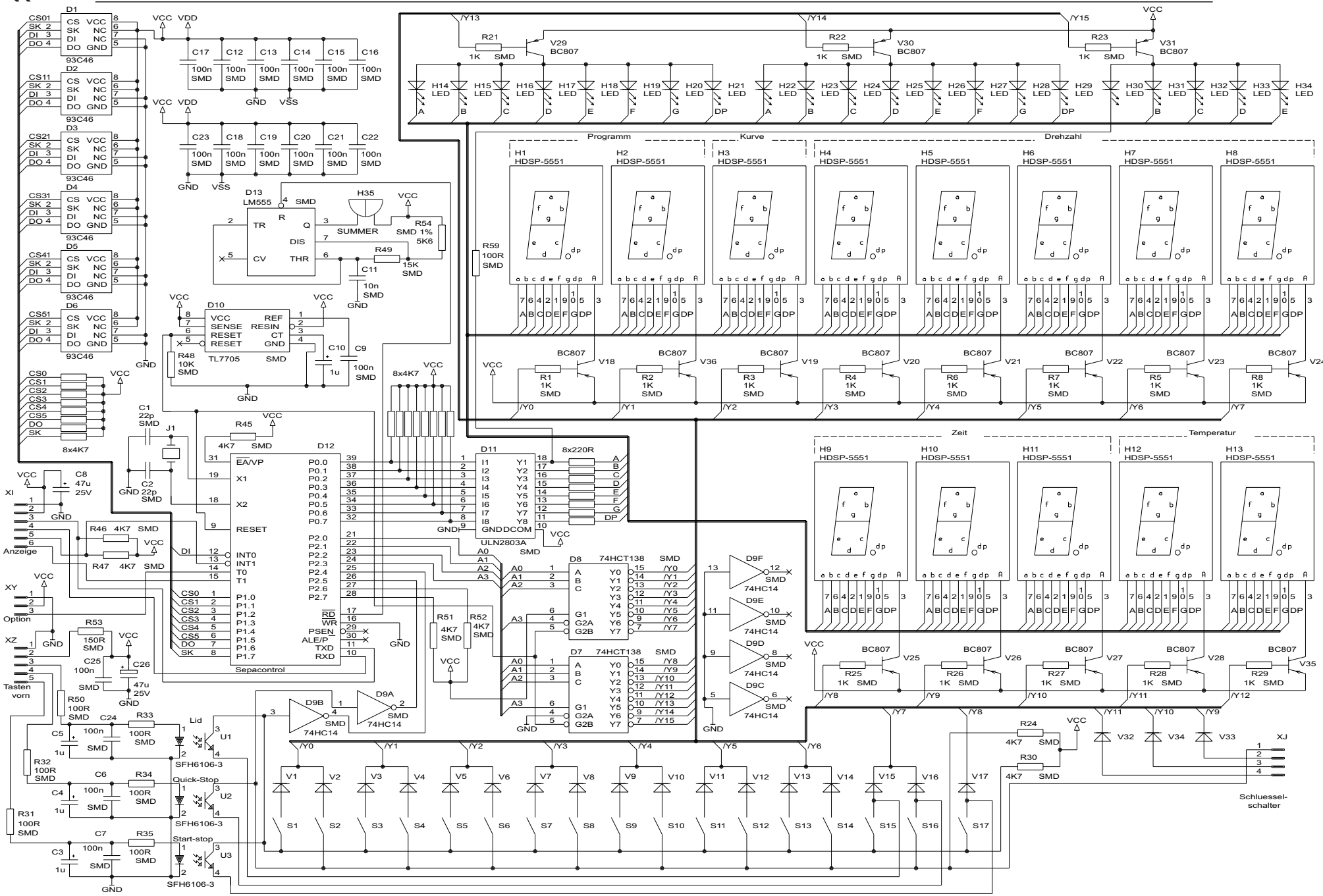
Low Voltage Power Supply

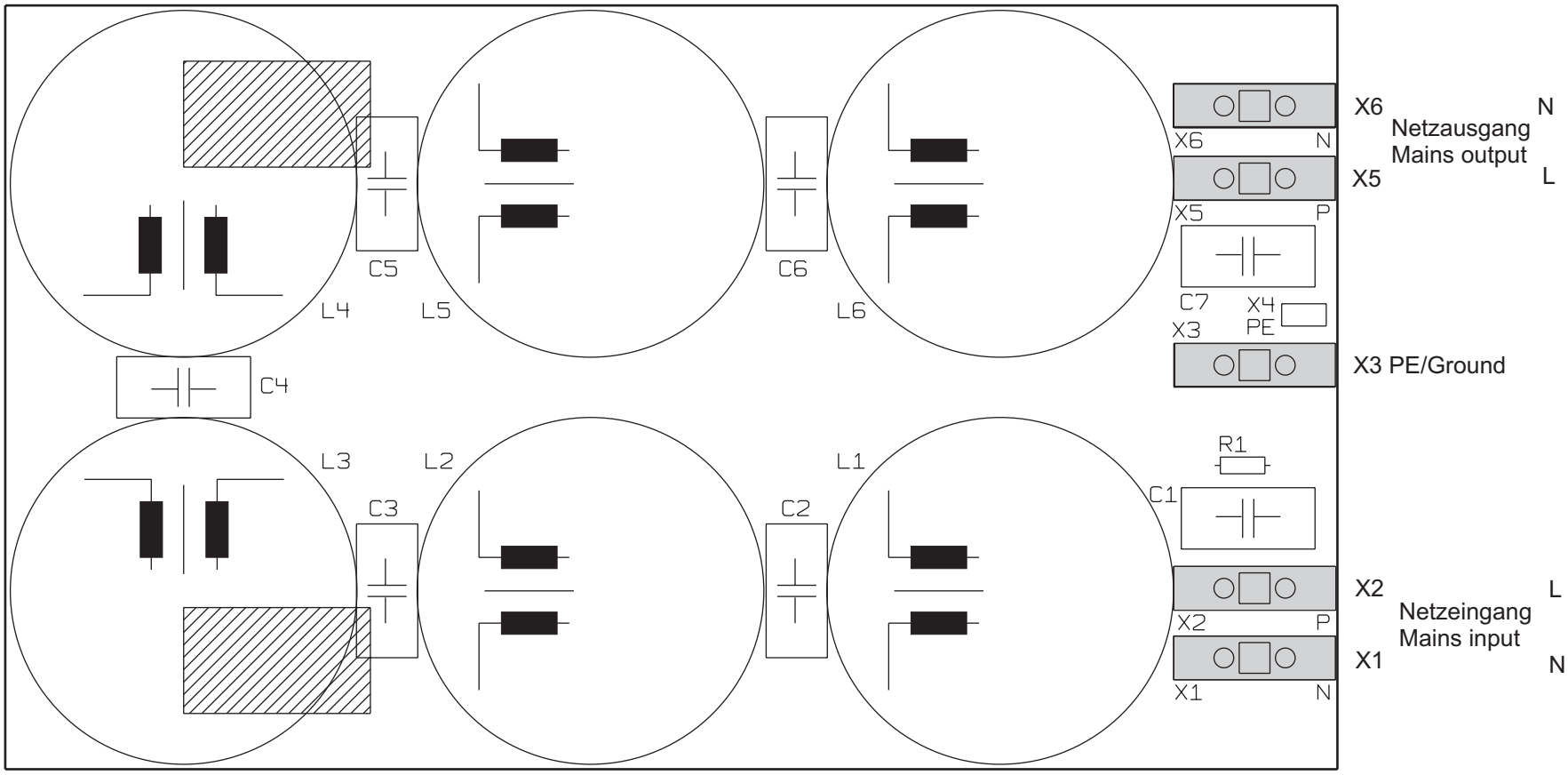


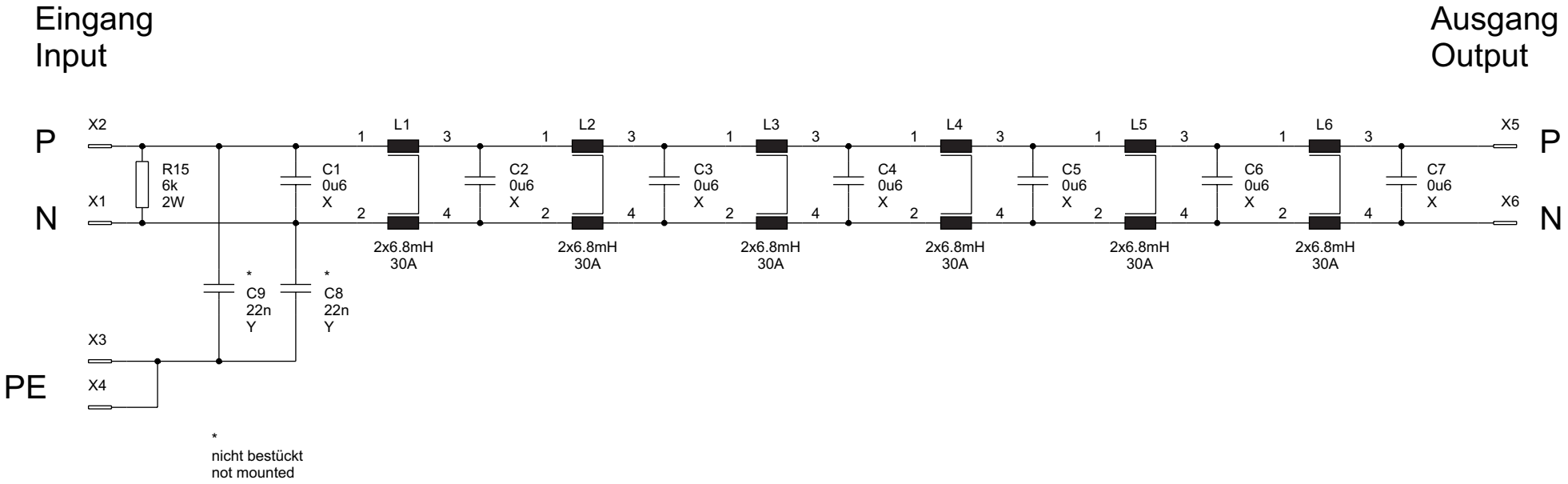
Latch Controller



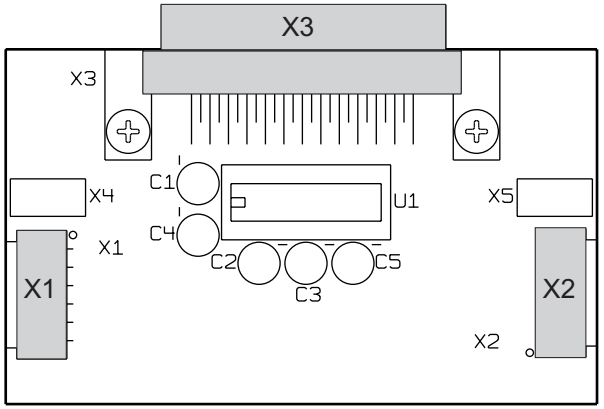

XJ
XY
XI
XZ


Programm
Kurve
Drehzahl
Zeit
Temperatur
Anzeige
Option
Tasten vorn
Sepacontrol
Quick-Stop
Start-stop
Lid
Schluessel-schalter
93C46
8x4K7
8x220R
ULN2803A
74HCT138
74HC14
HDSP-5551
TL7705
LM555
SFH6106-3

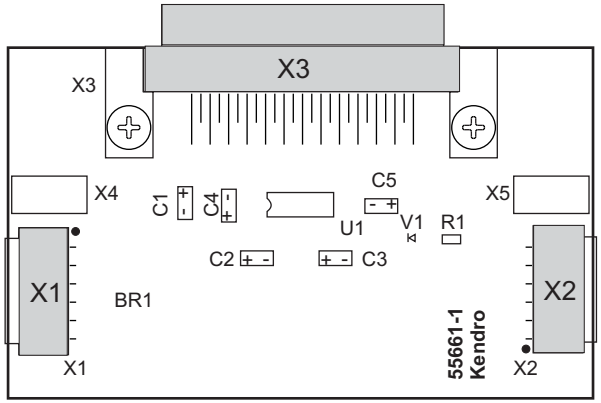

C5
C6
L4
L5
L6
C4
L3
L2
L1
C3
C2
R1
C1
C7
X4
PE
X3
X6
N
X5
P
X2
X1
X6 N
Netzausgang
Mains output
X5 L
X3 PE/Ground
X2 L
Netzeingang
Mains input
X1 N


Eingang
Input
Ausgang
Output
P
N
PE
X2
X1
X3
X4
X5
X6
R15
6k
2W
C1
0u6
X
C2
0u6
X
C3
0u6
X
C4
0u6
X
C5
0u6
X
C6
0u6
X
C7
0u6
X
C8
22n
Y
C9
22n
Y
L1
L2
L3
L4
L5
L6
1
2
3
4
2x6.8mH
30A
*
nicht bestückt
not mounted

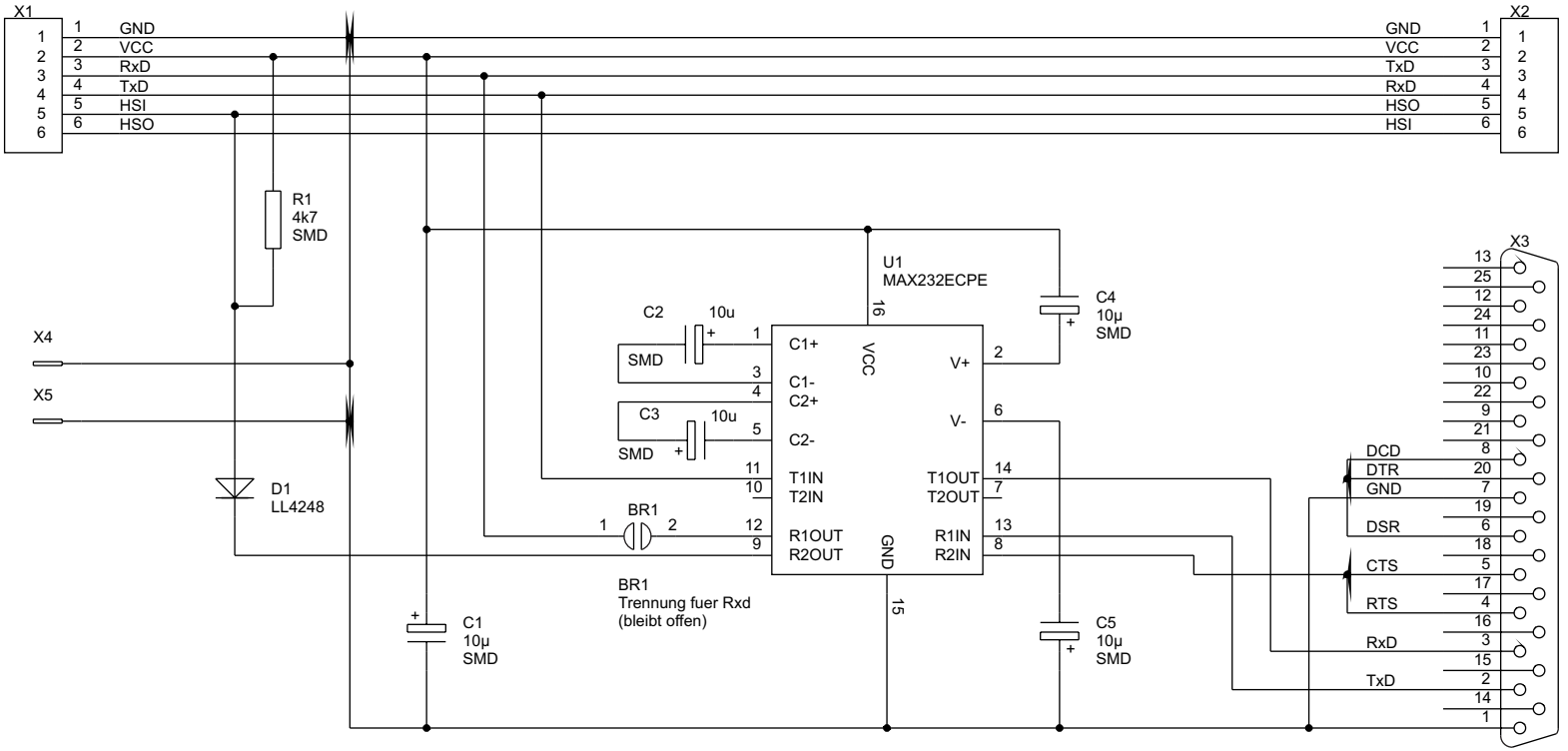
Alte Ausführung
old version



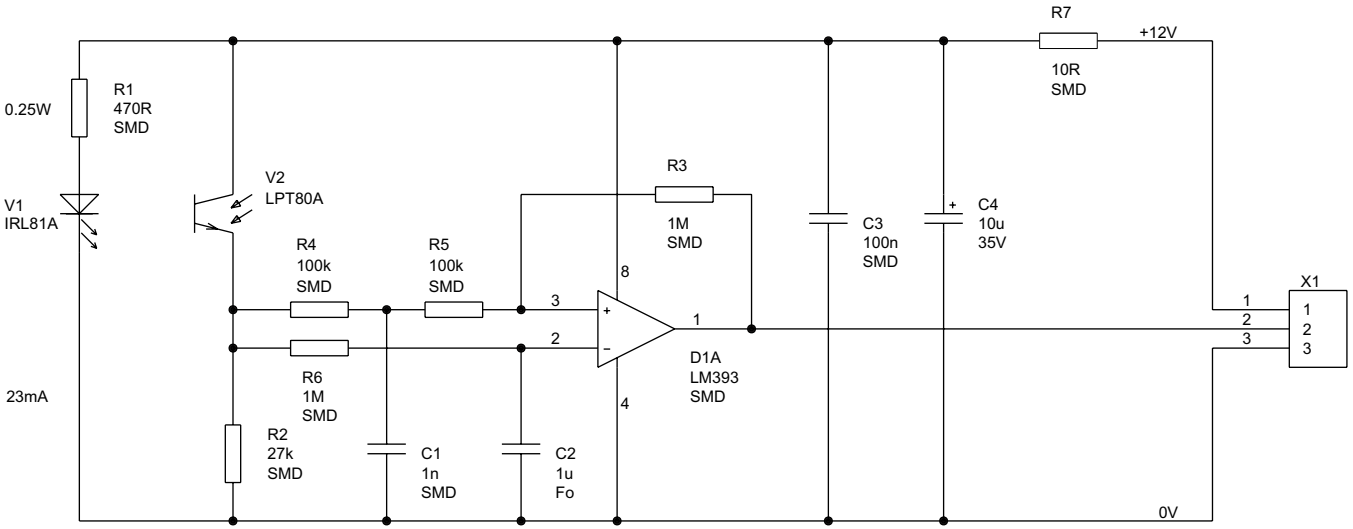
Neue Ausführung
new version

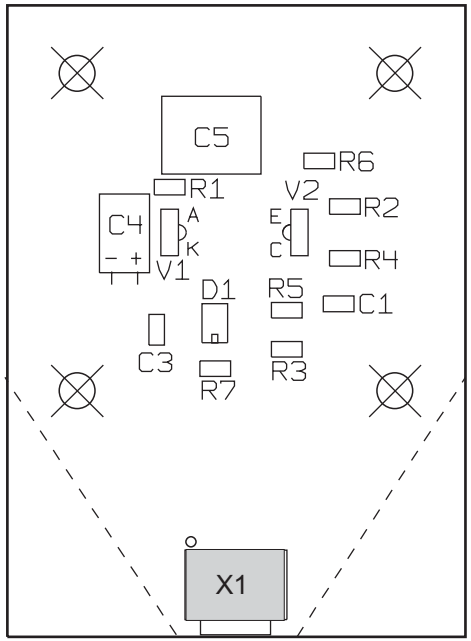


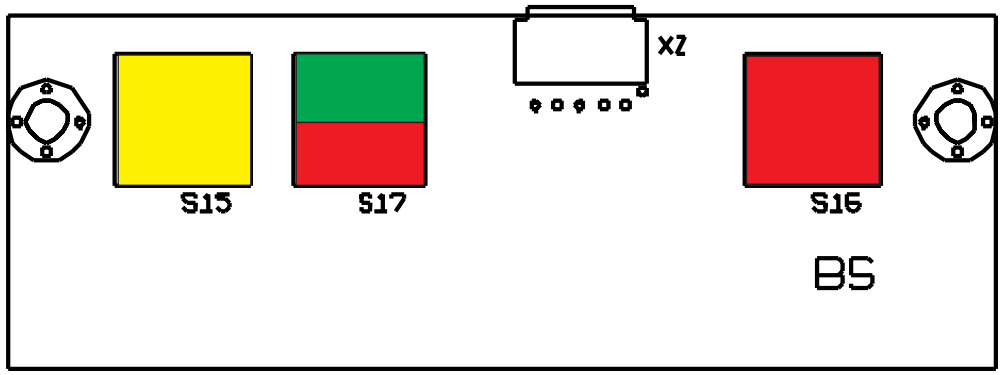
Hauptplatte
Mainboard

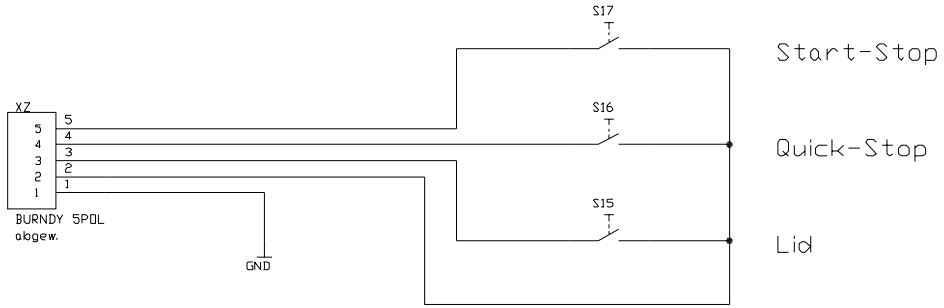


Tasten- und Anzeigenplatte
Key and Indication Board


R7
+12V
10R
SMD
0.25W
R1
470R
SMD
V2
LPT80A
V1
IRL81A
R3
1M
SMD
C3
100n
SMD
C4
10u
35V
R4
100k
SMD
R5
100k
SMD
X1
1
2
3
D1A
LM393
SMD
23mA
R6
1M
SMD
R2
27k
SMD
C1
1n
SMD
C2
1u
Fo
0V


C5
R6
R1
V2
R2
C4
A
K
E
C
R4
V1
D1
R5
C1
C3
R7
R3
X1


XZ
S15
S17
S16
BS


S17
Start-Stop
S16
Quick-Stop
S15
Lid
XZ
5
4
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2
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BURNDY 5POL
abgew.
GND

5. Replacement of Components

The index numbers stated in ( ) reappear within the spare part figures (block diagram, schematic diagram of cooling plant) and the spare part lists.

5.1 Dismantling the Housing

5.1.1 Front-door (100)

- Pull mains plug
- Open the front door by help of square box spanner
- Remove nuts from hinges and take door with hinges apart
- When replacing front door change latch and hinges from old to new door
- The insulation cannot be taken from old door and has to be ordered
- Reassemble the door analogously in reverse order and take care of the correct connection of the grounding strip
- To adjust the position of the door loosen the nuts of the hinges and move the door into correct position

5.1.2 Back panel

- Pull mains plug
- Screw in feet and move unit forward about 1 m from the wall
- Remove all flat head screws at the back panel
- Disconnect ground wire and take panel away

5.1.3 Door

- Open door
- Pull mains plug
- Attention! The weight of the door is about 60 kg (130 pd) Two men are required to handle the door
- Remove retainer rings at the bolts of the gas lid stay and push the bolts carefully. Move the door a little backwards.
- Remove 12 screws at the hinge on top of the bench top.
- Take door with hinge away.
- When replacing the door install old joint blocks and hinge at the new door

5.1.4 Control panel housing

- Open rear panel of the control panel housing and disconnect all electrical wiring
- Remove 2 screws each left and right side of the housing
- Take housing away

5.1.5 Levelling feet

- Open front door and remove back panel
- Loosen nut with help of a 24 mm spanner underneath of the chassis
- Remove two screws each foot of the bracket and screw in the bolt nearly up to the top
- Take chock element (foot) away
- Screw out the bolt. It could be possible that you have to lift the centrifuge by help of a piece of wood if the floor is not levelled.
- Reassemble the foot analogously in reverse order

5.2 Dismantling of sealing elements

5.2.1 Motor rubber flange

- Open the door
- Remove rotor from instrument (see page 19 in operating instruction) with help of spanners 17/19 mm and 10 mm
- Remove screws from white flange on top of the motor.
- Check felt washer inside the hole for correct lubricating, if necessary make new lubricating or replace it, we recommend once a year.
- Remove screw at stainless steal ring and pull red rubber flange to the top.
- Reassemble new parts analogously in reverse order

5.2.2 Door seal

- Open door and remove it – see 5.1.3
- Remove back panel and open front door
- Remove door latches
- Remove control panel housing
- Remove two threaded bolts underneath of the middle chassis from front side
- Remove screws at the rear side of the bench top
- Take bench top away
- Pull seal from cooling bowl and replace it with new one. Take care that the glued rim is placed to the front
- Bring bench top into correct position and pull seal lip from underneath to the upper side of the bench while pressing bench top down
- Move seal with both hands into correct position. Take care that the seal will not be bent somewhere
- Fasten the bench top with all screws and bolt
- To insure that the air can come out of the seal ring cut two small holes at the hinge side into the rubber bulge from out side that they cannot be seen by anybody
- Make final check that the seal is correct position especially attached to the cooling bowl

5.3 Replacement of mechanical Components

5.3.1 Door latch

The door latch including micro switches motor is only available as one group. Single components are not available. Both latches are identical.

- Remove door latch plate
- Remove two hex screws outside of the brackets
- Take a welding wire and bent one end a little to allow holding of the latch when removing the screws. Take care that the wire will be placed under the centre bolt of the latch mechanism.
- Remove two Phillips screw whilst holding the latch with the wire
- Lower the latch
- Move the bracket to the bowl and then take it out to the top
- Take out the latch to the top and disconnect wiring and string
- Install new latch analogously in reverse order
- Place the latch in a position that the hook fits exactly in the centre of the slot. Check by opening and closing the door several times

Attention! It could be possible that you have to tie an additional string to the emergency release string behind the front door. Otherwise it could happen that this string will be pulled into the unit. After installation of the latch watch the string that it moves freely.

5.3.2 Gas lid stay

In any case of a failed gas lid stay fundamentally both have to be replaced. Change one after the other to prevent the door falling down.

Replacement of the front one

- Open the door
- Remove retainer ring from the bolt and remove bolt
- Open the front door and locate two hex screws underneath of the chassis. Remove this two screws
- Take out the gas lid stay complete with holder
- Replace gas lid stay and install it analogously in reverse order

Replacement of the rear one

- Open the door
- Remove back panel
- Remove retainer ring from the bolt and remove bolt
- Locate two screws from the back just above the injection valve
- Remove the screws and take out the gas lid stay with holder so that you can remove the screw of the gas lid stay. Take care that you do not bent the pipes of the cooling plant.
- Take the gas lid stay out to the top
- Install new gas lid stay analogously in reverse order

5.3.3 Bench-top (320)

- Open door and remove it – see 5.1.3
- Remove back panel and open front door
- Remove door latches
- Remove control panel housing
- Remove two threaded bolts (327) underneath of the middle chassis from front side
- Remove screws at the rear side of the bench top
- Take bench top away and replace it
- Bring bench top into correct position and pull seal lip from underneath to the upper side of the bench while pressing bench top down
- Move seal with both hands into correct position. Take care that the seal will not be bent somewhere
- Fasten the bench top with all screws and bolt
- Make final check that the seal is correct position especially attached to the cooling bowl

5.4 Replacement of electrical components

ATTENTION - CMOS components! Discharge your body before handling!

5.4.1 Mainboard replacement

The mainboard will be shipped without any software like CPU, NVRAM. This has to be taken from old board or has to be ordered separately

- Pull mains plug
- Remove back panel
- Confirm that there is no voltage onboard by measuring the voltage at the capacitors and watching the LED H1
- Remove the wiring from the terminals of the board. If necessary mark them.
- Remove screws and take mainboard apart
- Remove NV RAM from new board. These are empty components and should be scrapped
- Exchange software to new board and reassemble the device in reverse order and perform a test run, making sure the drive turns in the right direction (see imprinted arrow on rim of rotor chamber)!
- An adjustment of the PCB is not possible
- **NOTE! If you are going to install the new style main board in older units with mechanical latch you have to take the old software to set up the board.**
- **The new software would not control the old latches. Also the two wires from mains contactor feedback will not be connected to the board. There is no terminal XR on the newer board.**

5.4.2 NV-RAM on mainboard

- Write down software version code which comes up after power on
- Remove back panel
- Locate NV RAM on mainboard and remove them from socket
- Install new NV RAM – watch correct position (mark on label)

Note! It could be possible that there is an updated software which will be displayed with new version after power on. Write down this information in the book

5.4.3 Microcontroller (CPU) replacement on mainboard

- Write down software version code which comes up after power on
- Remove back panel
- Locate CPU on mainboard and remove them from socket
- Take IC extractor and remove it from socket
- Install new CPU- watch correct position (pin 1 or mark on component)

5.4.4 Interference board

- Remove back panel
- Disconnect wiring from terminals
- Remove fastening screws
- Install new PCB analogously in reverse order

5.4.5 Key- and indication board

- Open back panel of control housing
- Disconnect wiring to RS 232 board
- Remove screws of the board and take PCB off
- Install new PCB analogously in reverse order

5.4.6 RS 232 or RS 485 Interface

- After opening the control housing panel the screws of the RS board can be reached and the board can be removed completely

5.4.7 Brake resistor (fan)

- Remove back panel
- Disconnect wiring from brake resistor to PCB at the terminal
- Disconnect the grounding wire at the bolt
- Remove two Phillips screws at the bracket and take the fan completely away
- Change the brake resistor (fan) and install it on the bracket
- Install bracket complete into the unit

5.4.8 Electronic fan

- Remove back panel
- Remove four screws at the fan console.
- Disconnect the wiring and take console completely away
- Remove fan from console by removing 9 self tapping screws
- Install new fan analogously in reverse order

5.4.9 Mains cable

- Remove back panel
- Open front door
- Disconnect mains plug from wall socket
- Locate mains cable at the contactor on console behind the open front door
- Disconnect wires from contactor and the PE and Neutral from an extra terminal beside the contactor (3Ph/N/PE only)
- Remove the cable at the rear conduit fitting and pull the cable
- Install the new cable in reverse order. Take care of the correct wiring.

3Ph – N – PE: (3x400V/N/PE)
Green/yellow – Ground
Blue – Neutral
Brown – Phase L1
Black – Phase L2
Black – Phase L3

3Ph – PE: (3x230V/PE and 3x208V/PE)
Green – Ground
Black – Phase L1
Red – Phase L2
White – Phase L3

1Ph – N – PE: (1x230V/N/PE and 1x208V/N/PE)
Green – Ground
Black – Phase L1
White – Neutral

5.5 Replacement of Drive Components

5.5.1 Drive motor (second person required)

- Remove rotor from instrument
- Remove motor flange
- Remove back panel
- Open front door
- Locate motor wires, tacho generator and disconnect them from mainboard
- Remove two screws from contactor console and place the console on side
- Remove ground strip at the motor
- Remove screws of imbalance bracket and place it on side
- Remove 6 screws (13 mm) from anti-vibration mount package
- Tie a string through the air flow slots at the top of the motor to lift it
- Second person now lifts the motor by pulling the string. Place a piece of card box under the motor mount package to prevent damage of the chassis
- When second person lowers the motor move it out to the front
- Remove the motor mount package and tacho generator board from motor
- Install the new motor analogously in reverse order.
- Mount all other parts
- Perform a test run – check the sense of rotation. If necessary change two wires at terminal XM
- Perform a test run for imbalance check – see

5.5.2 Anti-vibration mounts

All anti-vibration mounts have to be replaced every 3 years as well the sand paper washers. Anti-vibration mounts must be replaced in a set. Watch numbers written on the rubber.

- Remove drive motor – see 5.5.1
- After removing the anti-vibration mount package from the motor it is possible to remove the hex recess screws
- After replacement of the AV-mounts secure the screws with paint
- Install the package under the motor and install the motor into the unit
- Perform a test run for imbalance test and sense of rotation.

5.5.3 Tacho-generator board

- Remove drive motor – see 5.5.1
- Remove anti-vibration mount package – see 5.5.2
- Remove 4 screws and take tacho PCB away
- Install new PCB analogously in reverse order
- Install motor and perform a test run – see

5.5.4 Replacement of parts of the imbalance switch

The imbalance switch consists out of a special micro switch and the mounting bracket After each modification at the drive system (replacement of parts) and imbalance switch several test runs have to be done to make sure that the unit allows maximum possible imbalance for the customer – but must cut off not allowed imbalance.
See extra section – adjustment of imbalance switch

5.6 Replacement of Condenser fan

5.6.1 Condenser fan

The air will be sucked in at the right side of the housing. The rear fan also cools the compressor. Both fans are controlled separately. The air will be pressed out at the back of the unit.

- Disconnect wiring at mainboard (terminal XK,XH)
- Remove 3 nuts at the rubber mounts and take the console with attached fan motor out
- Replace faulty motor with fan blade and install console with fan analogously in reverse order.

5.7 Replacement of parts of the cooling plant

5.7.1 Temperature sensor

- Take the rotor off
- Write down the distance of the sensor peak to the holder
- Remove set screw from sensor holder and pull sensor
- Pull the sensor through the bowl from underneath and disconnect sensor at mainboard
- Install new sensor analogously in reverse order and seal the cable at the bowl with silicone.

5.7.2 Parts of the compressor system – totally CFC-free

Repairs at the cooling plant require special experience and should only be done by well known engineers.
Observe national laws for servicing these systems.
Discharging refrigerant to atmosphere is prohibited because chloroflourocarbons are damaging ozone in the upper atmosphere. Recovering unit is recommended.
All soldering and brazing at the system should be done under flow of Nitrogen to prevent scale inside the pipes.
It is not allowed to use gauges, hoses, pumps, etc. which where contaminated by CFC-refrigerants.
First of all is to figure out that high ambient temperatures (ϑ_U >35°C), insufficient heat transfer (e.g. polluted condenser, de-heater, air gaps) or electrical errors (like defective fans, sensor or main board, potential relay or start-capacitor) can be excluded from the cooling problem (see function diagram of cooling plant 4-10: pressure / temperature ranges are valid for continuous cooling at max. speed, ϑ_U=25°C)!
Procedure for replacing defective components of the cooling cycle:

- Install gauge manifold to high and low side of the compressor
- When gauging too little static pressure perform a leakage test (N_2 max. 25bars)
- Discharge the refrigerant with suction device (recovery system) into recycling bottle
- In case of compressor fault, let the oil run out into a bowl to recycle it
- Perform oil acid test. If acid test is positive the unit has to be back-flashed
- Unsolder defective component(s) and replace the dryer/collector assy, too
- Let a little amount of dry nitrogen gas stream through the tubes when soldering to avoid scaling on the tube's inner surface
- Do the evacuation and refill the system with the exact amount of liquid refrigerant on the pressure side via a new external dryer (check amount with a balance or filling cylinder
- Reassemble the device and perform a cooling power test run

5.7.3 Charging information

Refrigerant:	R404a (HP 62) HFC	
Amount:	air-cooled:	1,6 kg (56,5 oz)
	Single phase:	1,5 kg (53 oz)
	GMP:	1,5 kg (53 oz)

Static pressure: about 8 bars (116 psi)

Working condition (after 3 hours run time):
Set temperature: +10 °C

3 x 400 V 50/60 Hz
Low pressure: 1,7 bars (24,6 psi)
High Pressure: 13,8 bars (200 psi)

3 x 230 V 50/60 Hz
Low pressure: 1,4 bars (20,3 psi)
High Pressure: 14,1 bars (204,5 psi)

Single phase 220 V / 60 Hz
Low pressure: 1,9 bars (27,5 psi)
High Pressure: 13 bars (188,5 psi)

Single phase 220 V / 50 Hz
Low pressure:
High Pressure:

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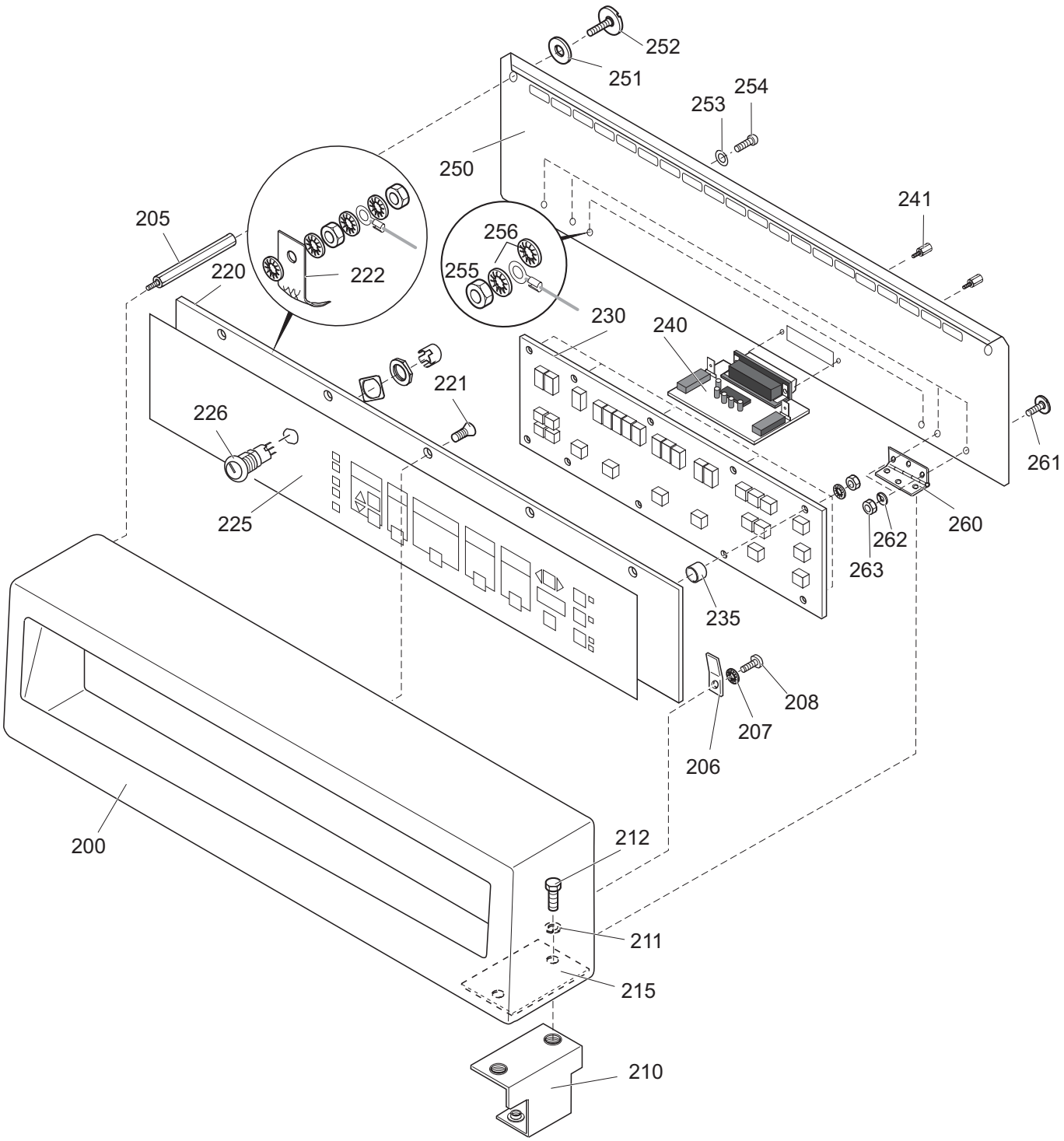
For Units without automatic lid lock, below S/N 272982



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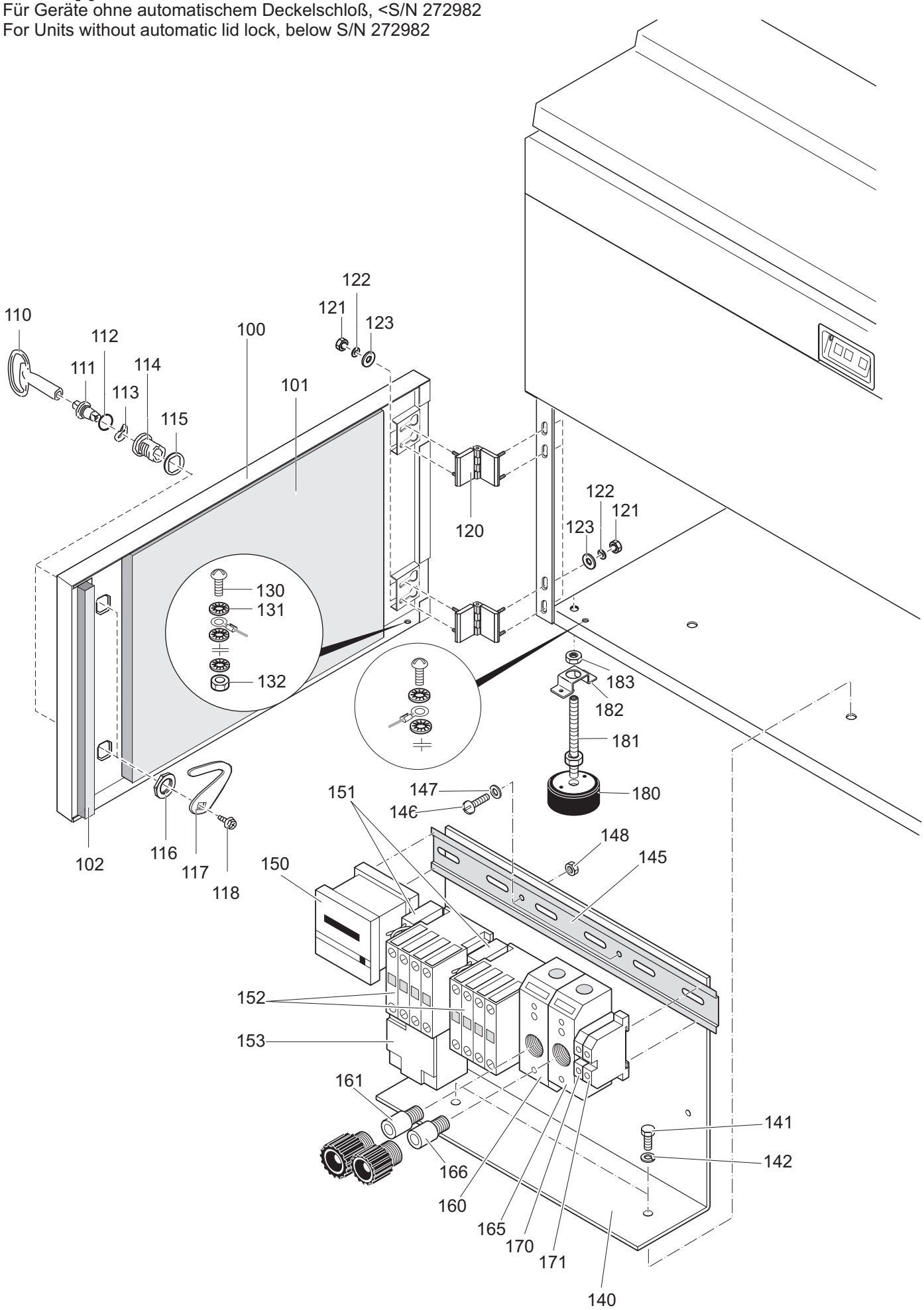

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For Units without automatic lid lock
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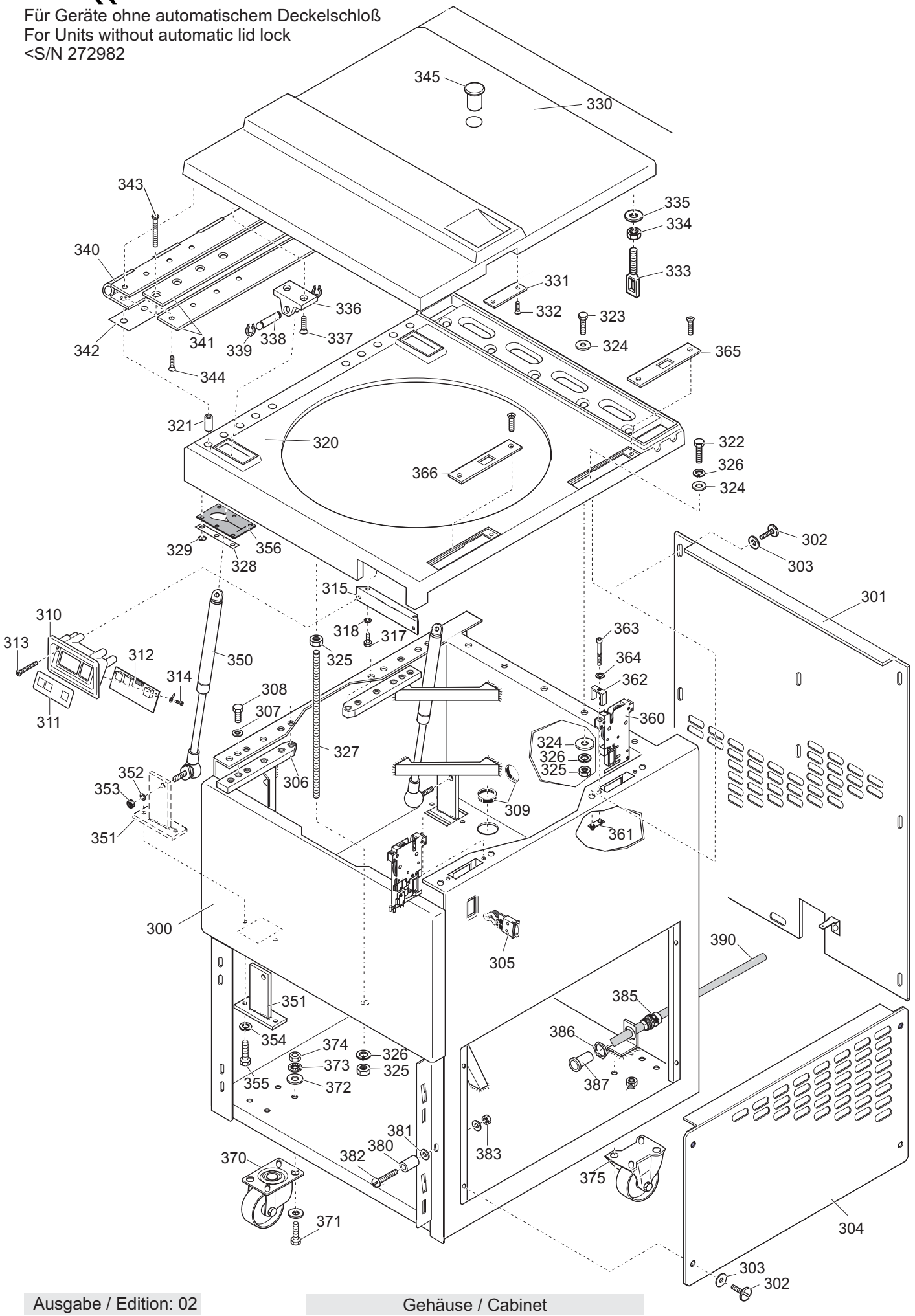

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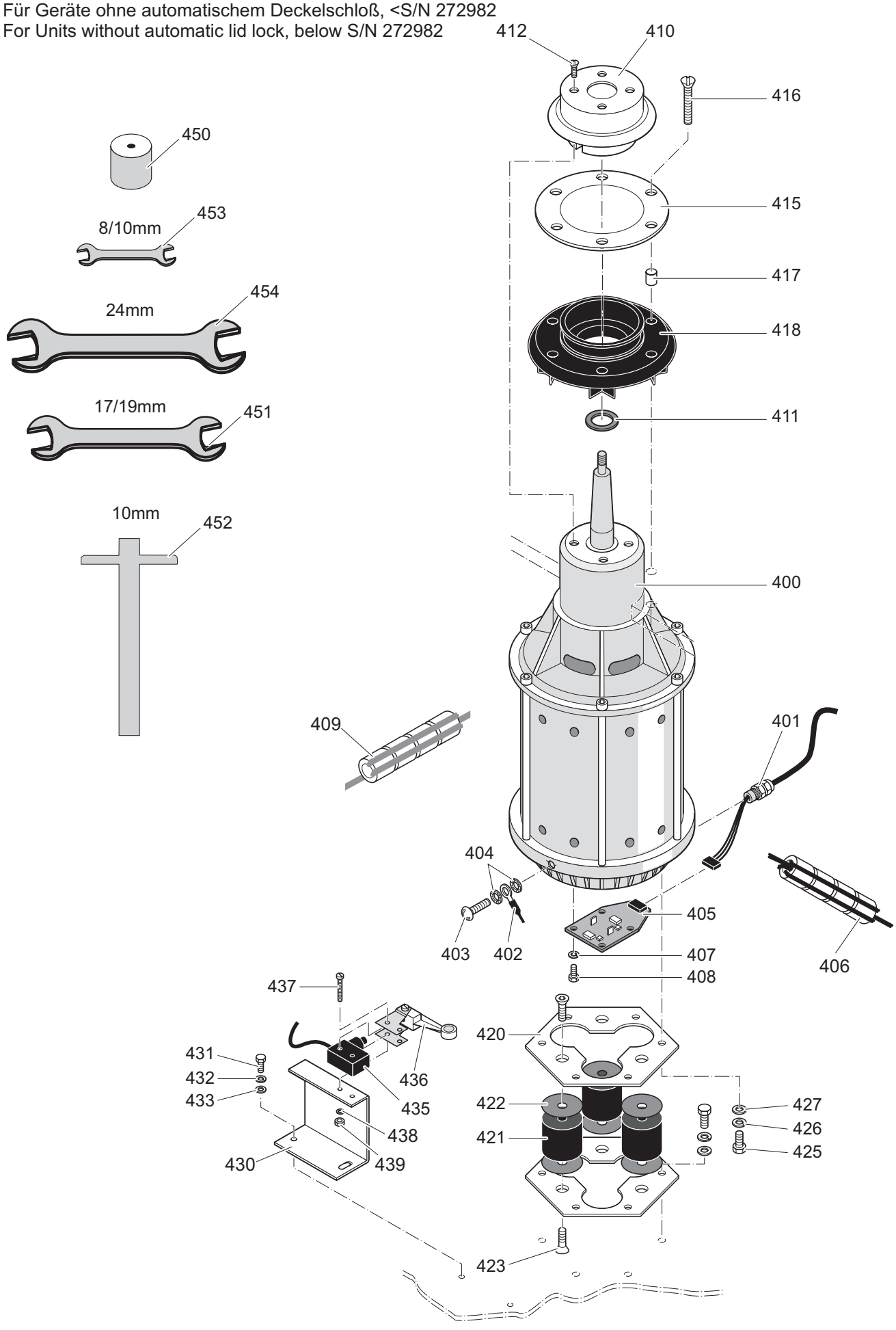

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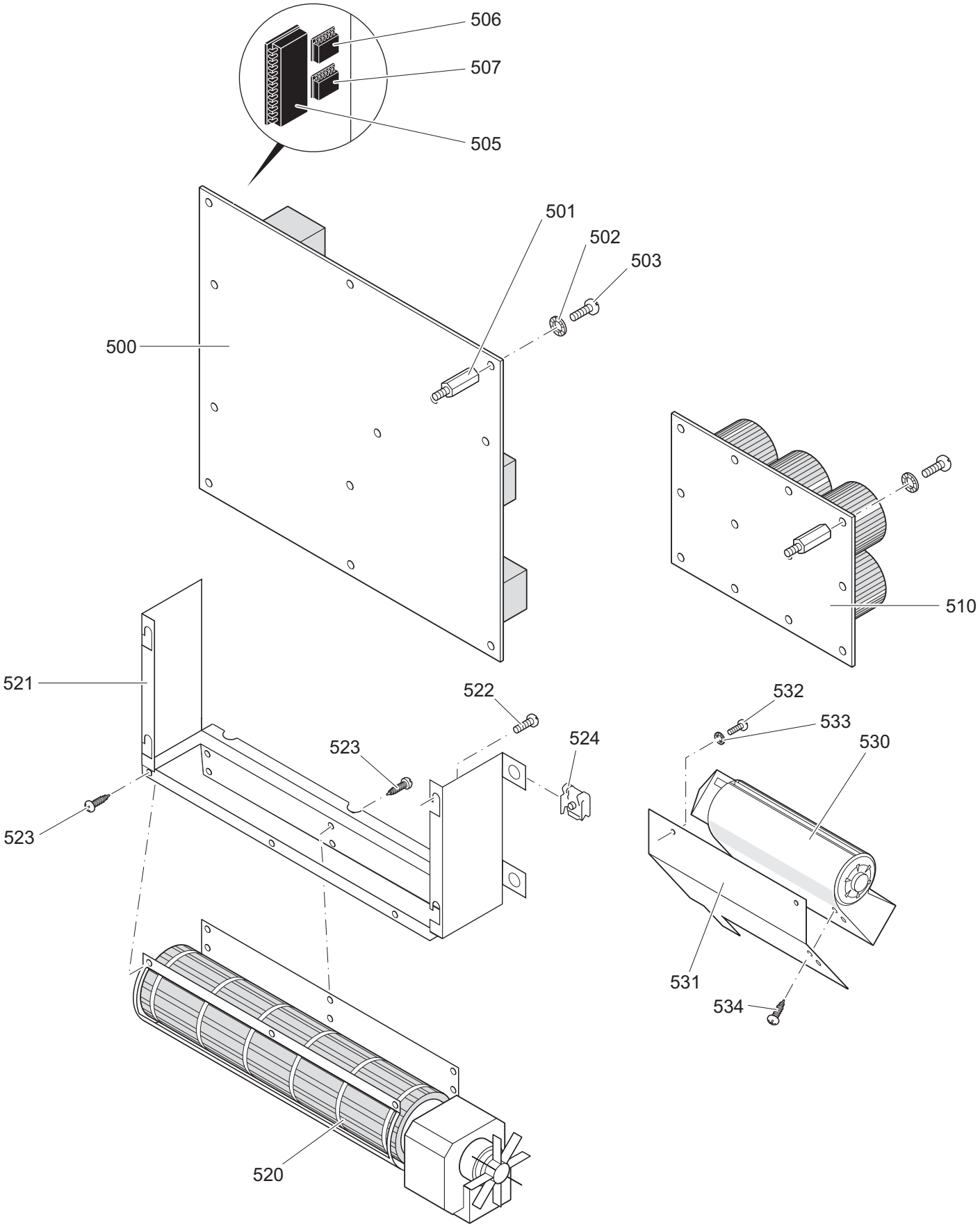

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For Units without automatic lid lock
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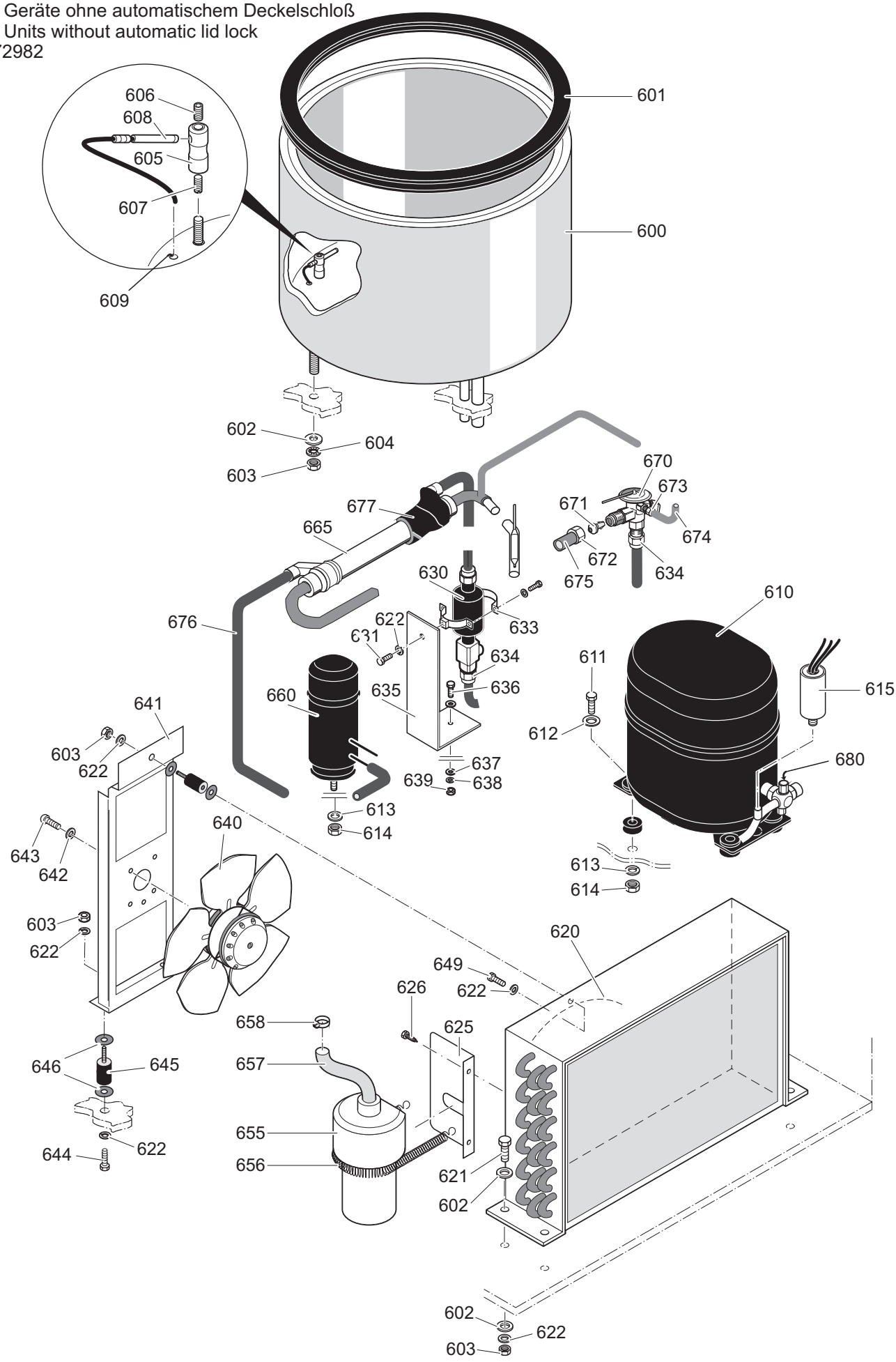

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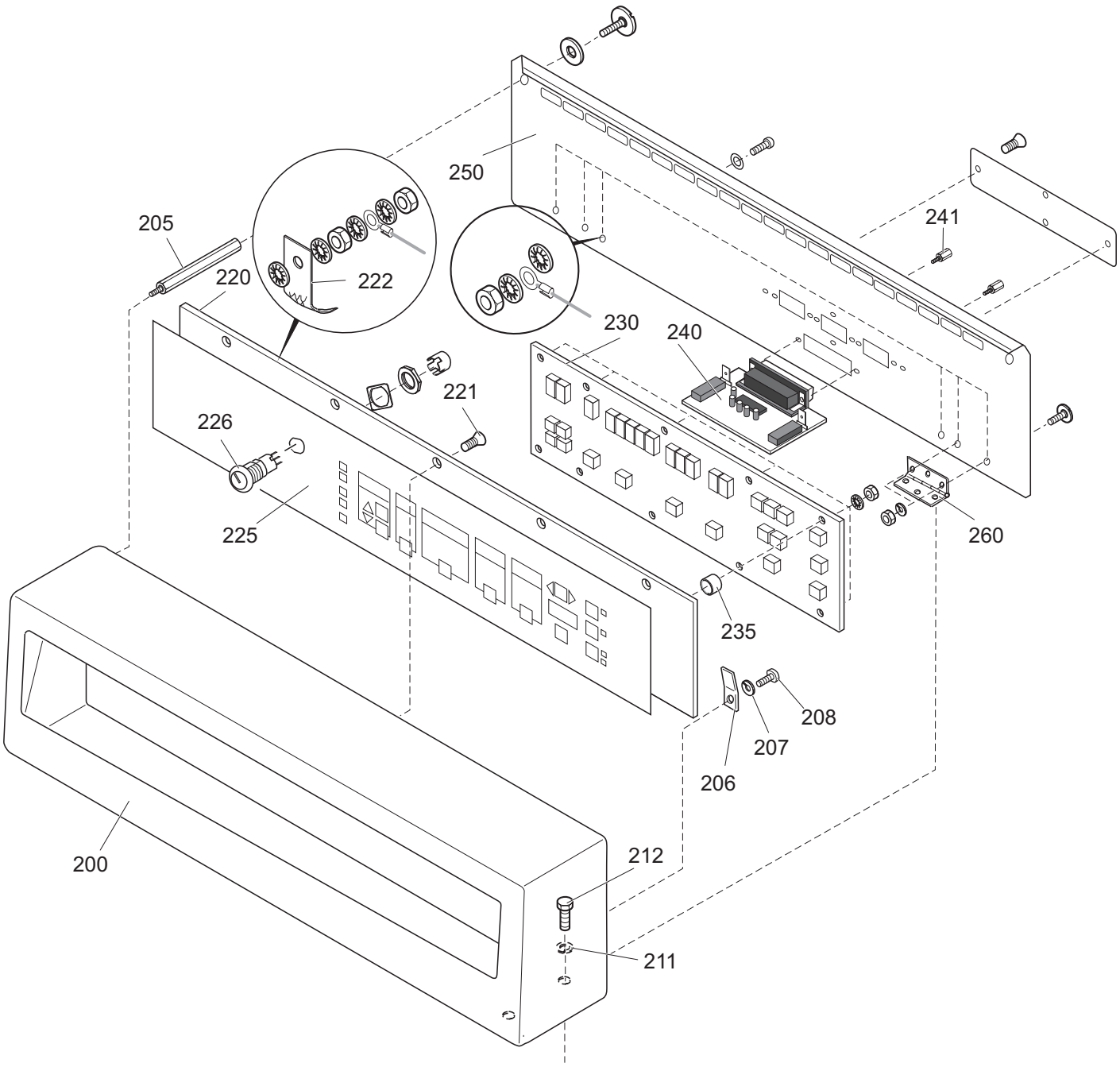

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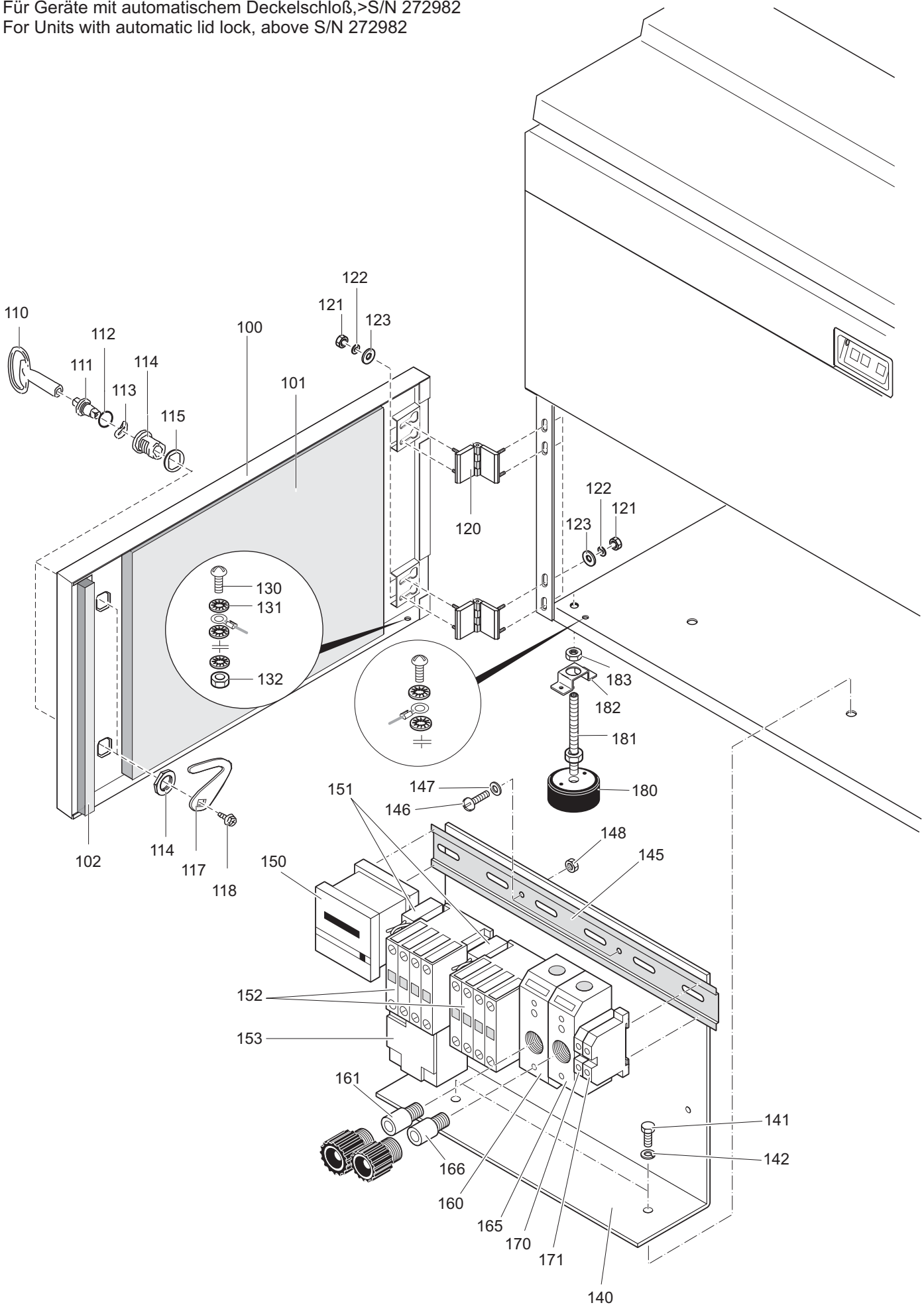

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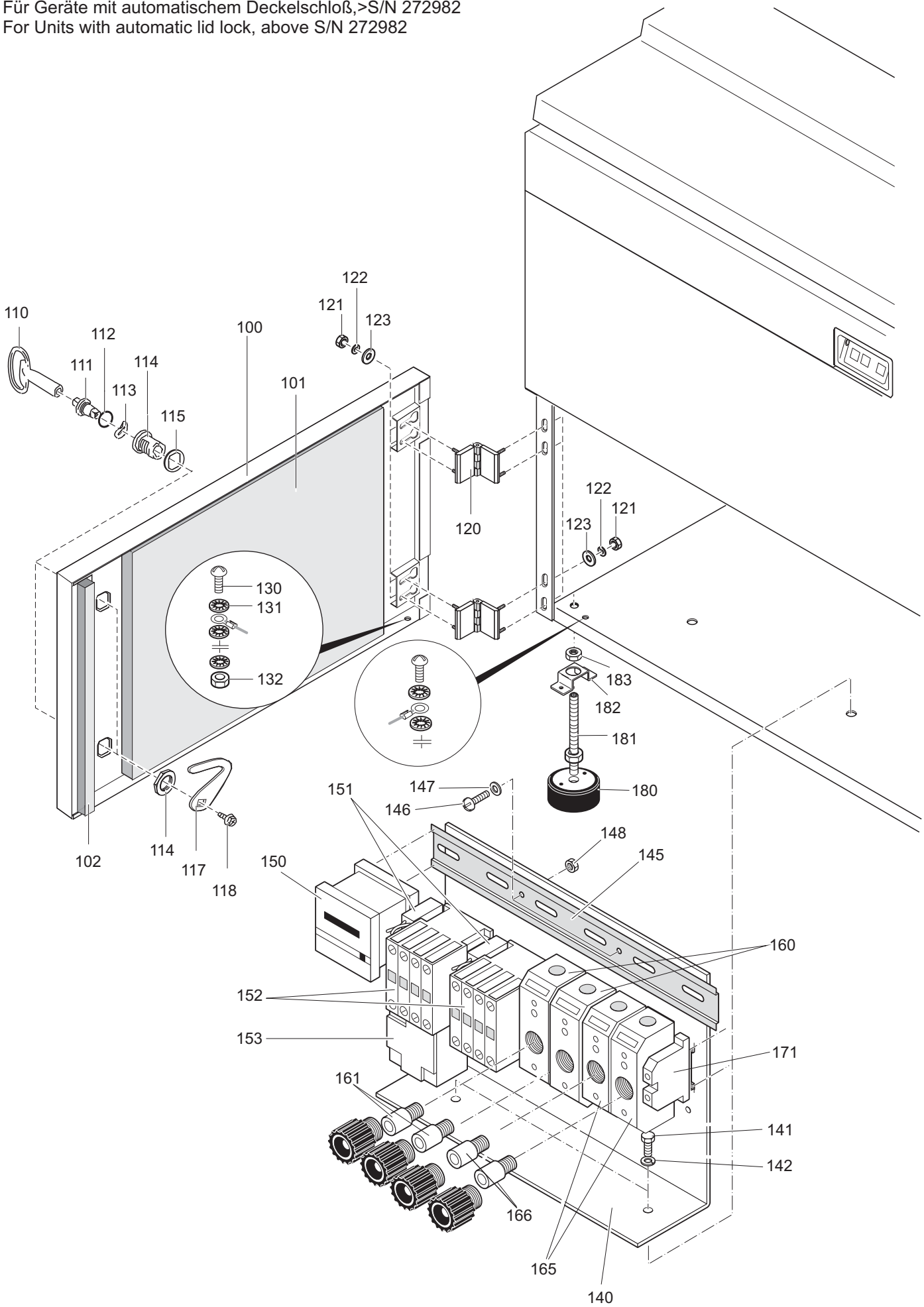

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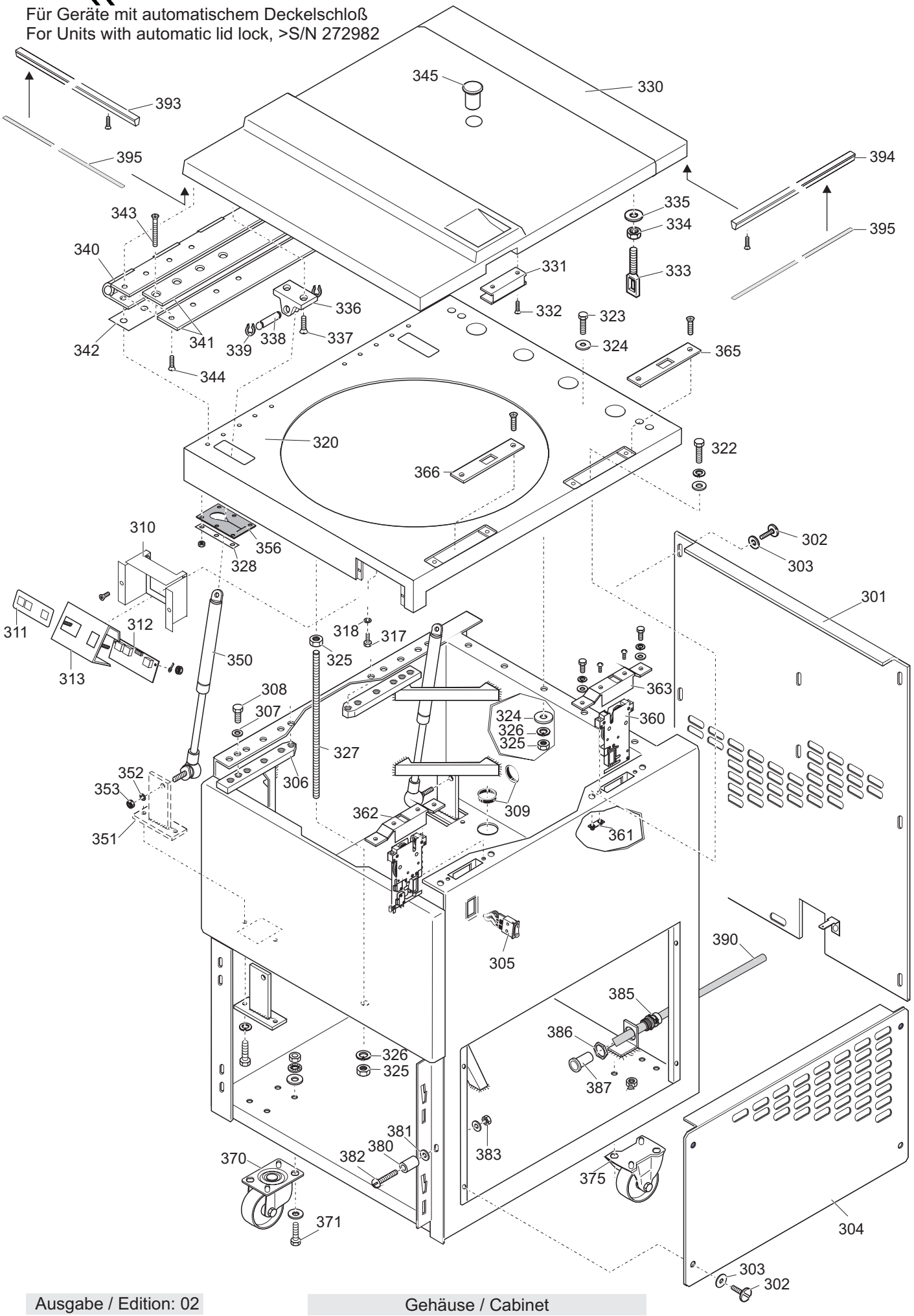

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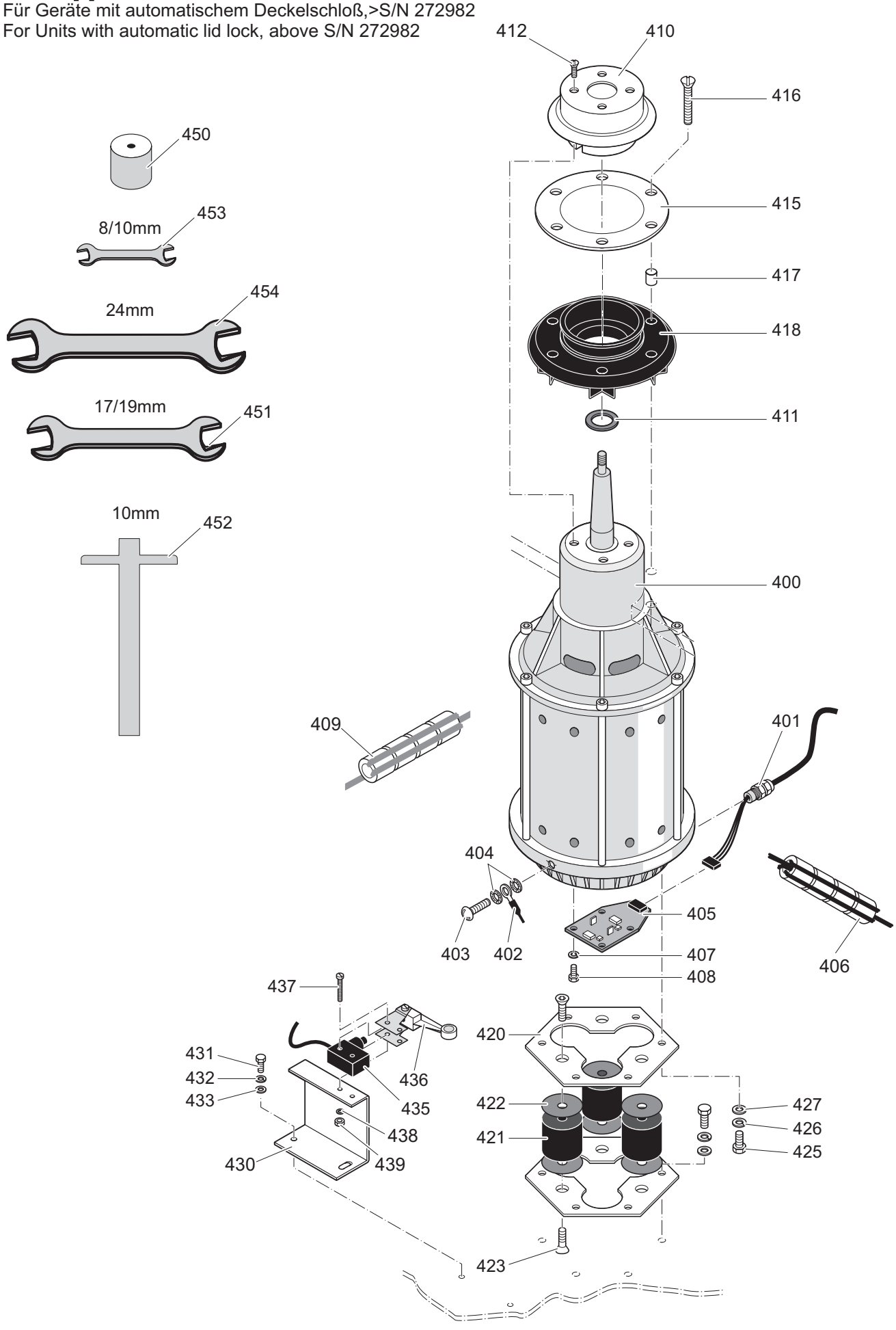

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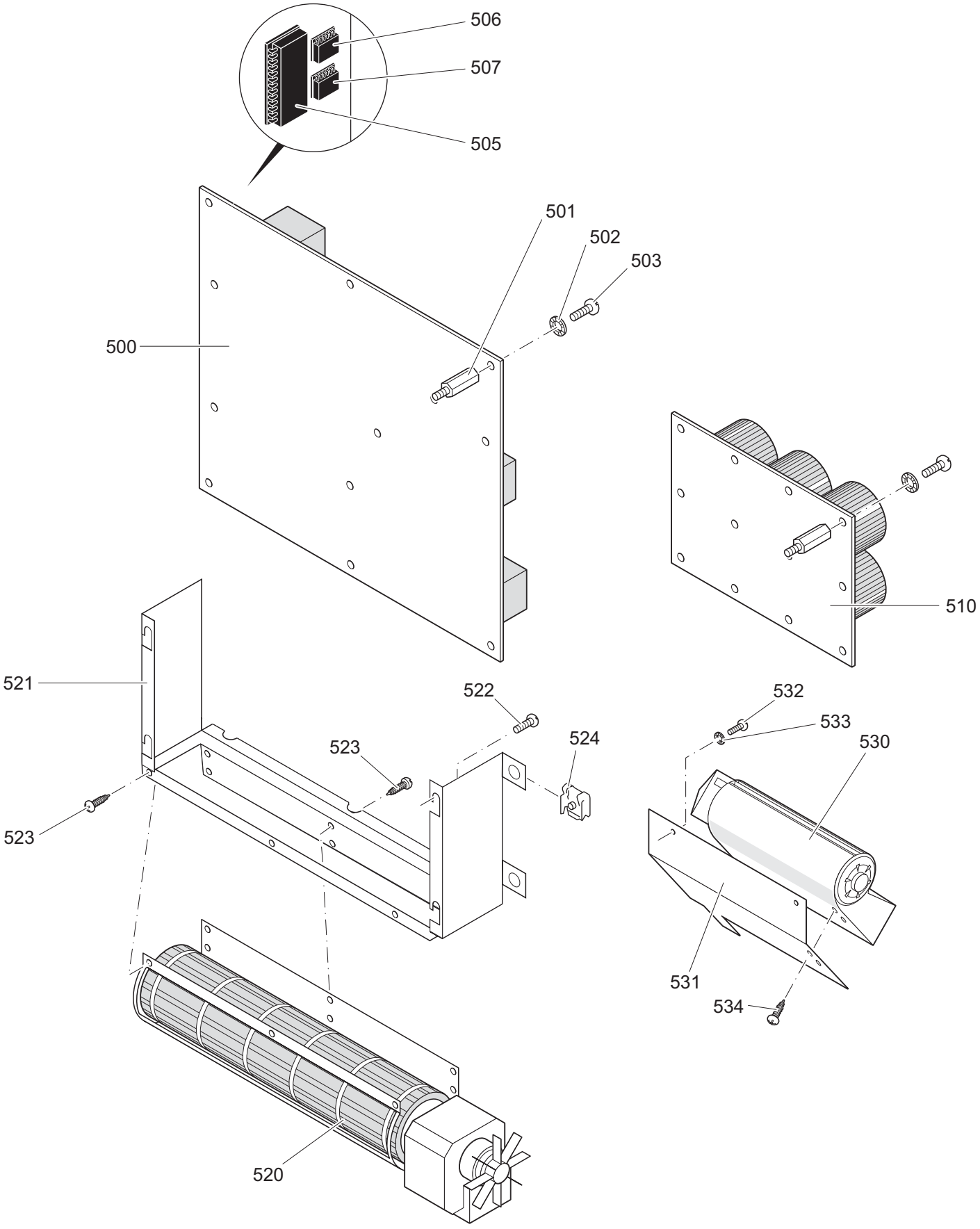

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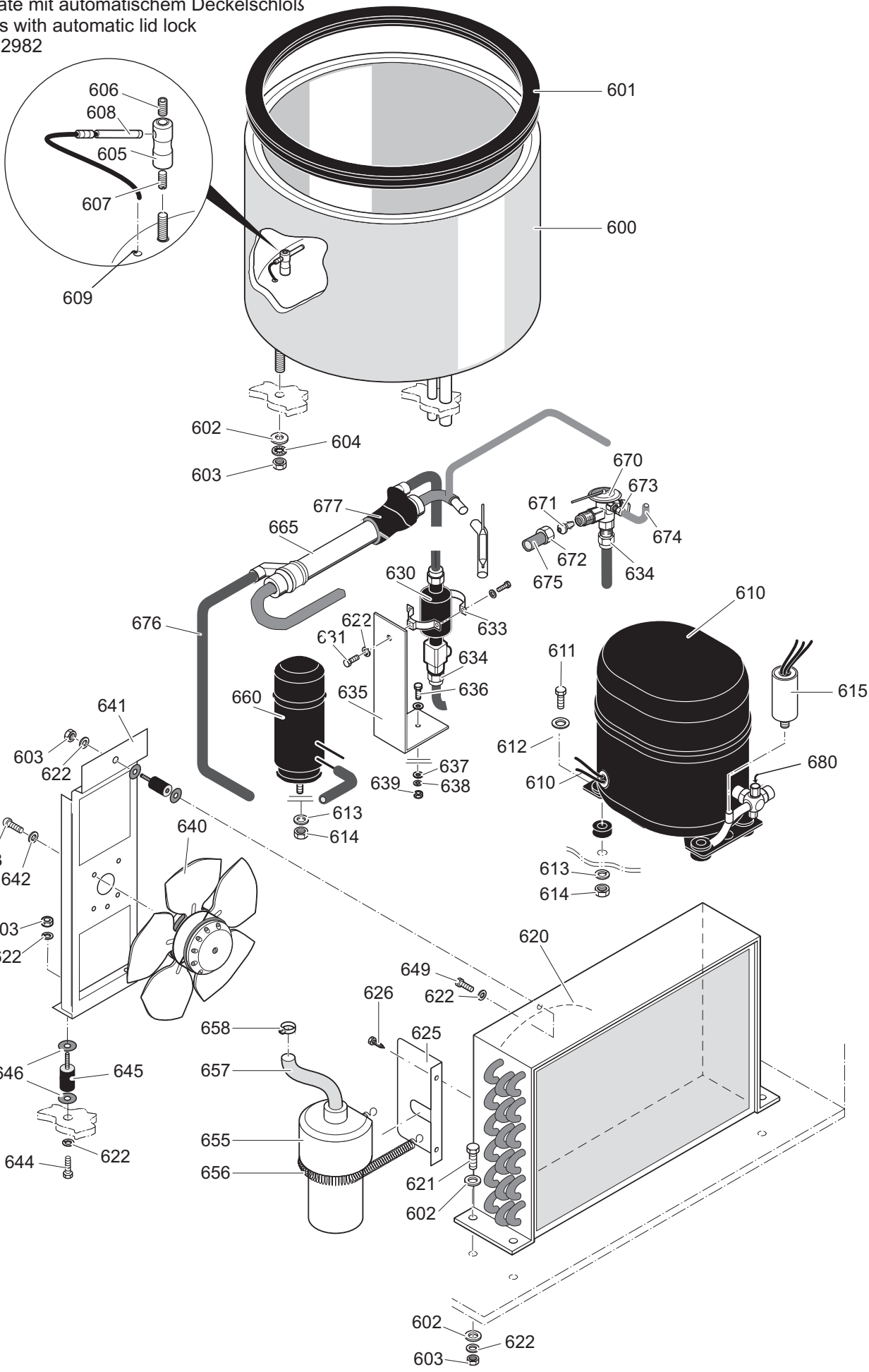

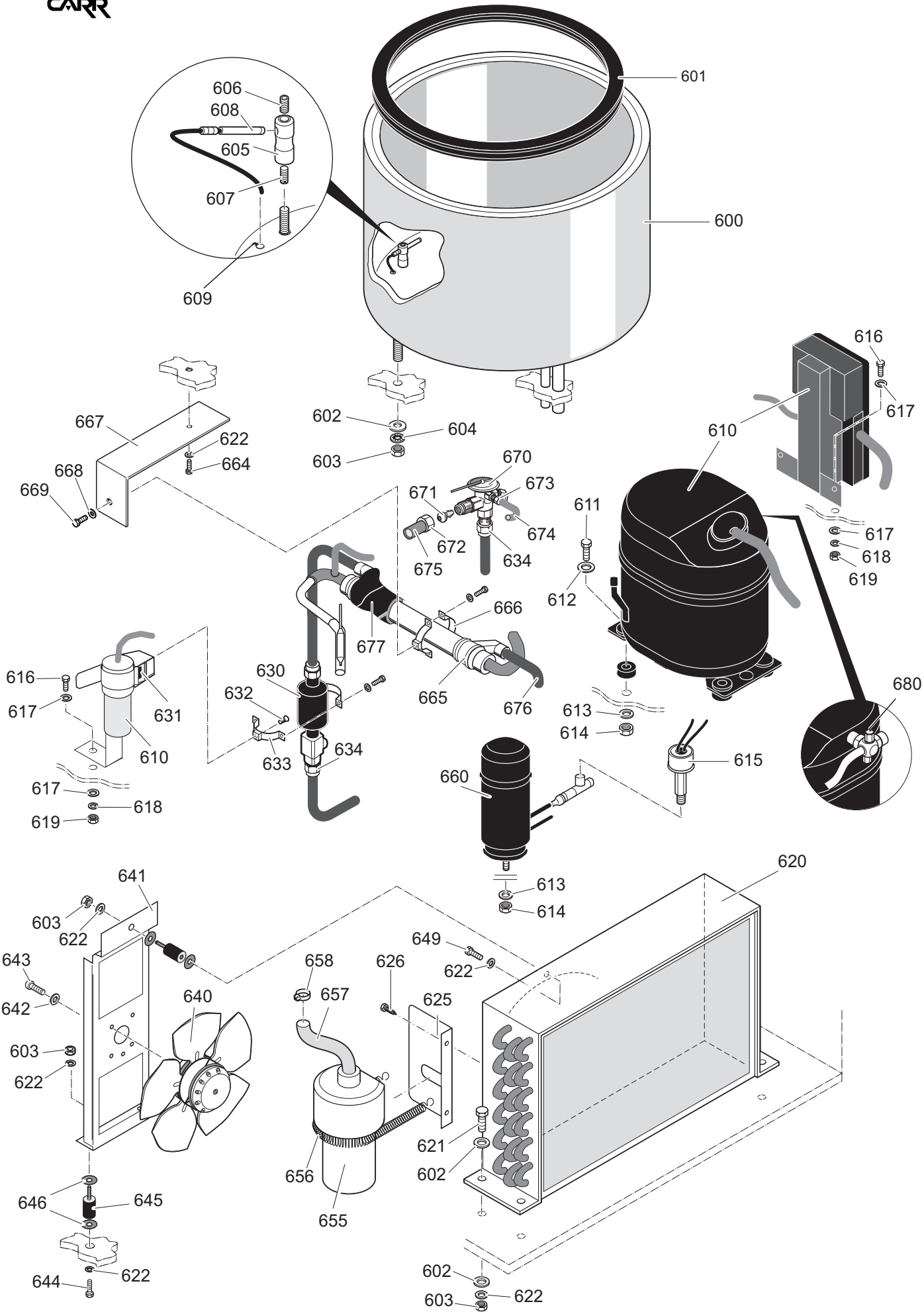
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Spare-Part-List

Kendro Laboratory Products

Plant Osterode

75007520_03 CRYOFUGE 6000I 400V 3N 50HZ HI

from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00100	70054651	FRONTPANEL
00101	20054686	Insulation
00102	10100209	TESA-MOLL
00110	20310260	KEY
00111	20310256	LOCK
00112	20310259	O-RING
00114	20310255	HOUSING
00115	20310258	SEAL
00117	20310323	HOOK
00118	20460095	SCREW PHILIPS M4 X 10
00120	20310261	HINGE
00121	20420077	HEXAGONAL NUT M5
00122	20480167	FAN WASHER A 5,1
00123	20480135	WASHER
00130	20430207	SCREW M 4 X 10
00131	20480108	FAN WASHER A 4,3
00132	20420076	HEXAGONAL NUT M4
00140	70054634	ANGLE
00141	20430216	SCREW M 6 X 12
00142	20480193	WASHER
00145	70054639	TRAVERSE
00146	20470089	SCREW M 5 X 10
00147	20480167	FAN WASHER A 5,1
00148	20420077	HEXAGONAL NUT M5
00150	20110261	HOUR COUNTER
00151	20540318	RC-COMBINATION
00152	20110262	CONTACTOR
00153	20110288	TEMP. RELAY
00160	20230196	FUSE HOLDER
00161	20230201	FUSE 20A
00165	20230165	Fuseholder
00166	20230199	FUSE 6A
00170	20220422	TERMINAL
00171	20220408	EARTH TERMINAL
00180	20907075	FOOT
00181	70054668	SCREW, ADJUSTABLE
00182	70054664	SECURITY DEVICE
00183	20420157	NUT

75007520_03 **CRYOFUGE 6000I 400V 3N 50HZ HI**

from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00184	20430258	SCREW M5X12
00185	20480167	FAN WASHER A 5,1
00200	70050952	HOUSING
00205	20049222	BOLT
00206	70050021	GRIP
00208	20460096	SCREW M5X10
00211	20480254	SECURING WASHER
00212	20430226	SCREW M 8 X 16
00221	20440212	SCREW M 5 X 10
00222	70907039	GROUNDING WIRE
00225	20907050	FRONTPANEL
00226	20180601	KEY SWITCH
00230	20150177	PCB DISPLAY
00235	70049526	SPACER
00240	20150117	INTERFACE V24 PCB
00241	20220489	SCREW COMPLETE
00250	70054630	BACKSIDE OF CONTROL PANEL
00254	20460090	SCREW M4X12
00255	20420076	HEXAGONAL NUT M4
00256	20480108	FAN WASHER A 4,3
00260	20310245	HINGE
00261	20460083	SCREW M 4 X 20
00262	20480244	LOCK WASHER
00263	20420076	HEXAGONAL NUT M4
00301	70054629	BACKPANEL
00302	20460085	SCREW M 5 X 12
00303	20250078	WASHER
00304	70054671	GRILL
00305	20180581	MAINS SWITCH
00306	20054663	THREADED PART
00307	20480157	WASHER
00308	20430215	SCREW M6X10
00309	20220472	PLASTIC RING
00310	70056259	Plate, inner
00311	20054650	FOIL
00312	20150118	PCB START-STOP
00313	70056253	Cover
00320	70900701	Benchtop

75007520_03 **CRYOFUGE 6000I 400V 3N 50HZ HI**

from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00322	20430221	SCREW M 6 X 30
00323	20430219	SCREW M 6 X 20
00324	20480157	WASHER
00325	20420070	NUT M 6
00326	20480251	SECURING WASHER
00327	20500179	Bar, threaded
00328	70049195	TERMINAL
00330	70056239	LID
00331	70056677	HANDLE PART
00332	20440286	SCREW M 4 X 10
00333	20052842	LID HOOK
00334	20420121	NUT M 10 X 1,25
00335	20480154	WASHER
00336	70049061	BEARING SUPPORT
00337	20440222	SCREW M6X20
00338	20049666	BOLT
00339	20480033	WASHER M8X0.8
00340	70054536	HINGE
00341	70054662	Spacer
00343	20440310	SCREW
00344	20440311	SCREW
00345	20051304	WINDOW
00350	20310244	GAS LID STAY
00351	70907072	PLATE
00354	20480251	SECURING WASHER
00355	20430217	SCREW M6X16
00356	20049196	RUBBER PLATE
00360	70003700	LID LOCK ASSY
00361	70051113	FIXING PLATE
00362	70053560	FIXING PLATE
00363	20510077	SCREW M 6 X 20
00364	20480157	WASHER
00365	70056253	Cover
00366	70056253	Cover
00370	20280123	CASTOR
00371	20430044	SCREW M8X20
00372	20480158	WASHER
00374	20420078	NUT

75007520_03 **CRYOFUGE 6000I 400V 3N 50HZ HI**

from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00375	20280124	CASTOR
00380	20054394	SPACER
00381	20480244	LOCK WASHER
00382	20460112	SCREW M 4 X 16
00383	20420076	HEXAGONAL NUT M4
00385	20220405	CABLE TIGHTENING
00386	20220453	LOCK NUT PG 21 M5
00387	20220459	CABLE PROTECTION
00390	70006709	MAINS CABLE
00400	20210327	MOTOR
00401	70907512	WIRING
00402	20190243	GROUNDING WIRE
00403	20430207	SCREW M 4 X 10
00404	20480108	FAN WASHER A 4,3
00405	20150102	SPEEDINDICATION
00406	20170316	FERROXCUBE
00407	20480242	SECURING WASHER
00408	20460098	SCREW M 3 X 6
00409	20170318	FERROXCUBE
00410	70054603	COVER-FLANGE
00411	20290541	FELT WASHER
00412	20470044	SCREW M 3 X 8
00415	20052927	WASHER
00416	20450081	SCREW M 5 X 55
00417	20049015	SPACER PIPE
00418	20052928	RUBBER FLANGE
00420	70054606	BASIS PLATE
00421	20054605	ANTIVIBRATION MOUNT
00422	10104080	WASHER (SAND)
00423	20510264	SCREW
00425	20430045	SCREW M8X25
00426	20480254	SECURING WASHER
00427	20480158	WASHER
00430	70054616	ANGLE
00431	20430216	SCREW M 6 X 12
00432	20480193	WASHER
00435	20180447	IMBALANCE SWITCH
00436	20180446	LEVER

75007520_03 CRYOFUGE 6000I 400V 3N 50HZ HI

from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00437	20460093	SCREW M 3 X 30
00438	20480242	SECURING WASHER
00440	70907505	WIRING, IMBALANCE
00450	20280119	WATER-LEVEL
00451	20034416	WRENCH
00452	20005492	BOX SPANNER 10 MM
00453	20360001	SPANNER 8MM
00454	20360008	SPANNER
00500	20150175	PCB 230V 50HZ
00501	20220482	SPACER
00502	20480244	LOCK WASHER
00503	20460095	SCREW PHILIPS M4 X 10
00505	70000498	PROCESSOR
00506	70907536	NV RAM
00507	70907556	EEPROM
00510	20150104	INTERFERENCE BOARD
00520	20210345	FAN
00521	70054623	CHASSIS
00522	20460096	SCREW M5X10
00523	20510252	SCREW 4,2X9,5
00530	70907521	FAN
00531	70054636	CHASSIS FOR BRAKE FAN
00532	20460096	SCREW M5X10
00533	20480167	FAN WASHER A 5,1
00534	20510174	SCREW 3,5 X 6,5
00600	70907041	EVAPORATOR
00601	20056252	SEAL
00602	20480193	WASHER
00603	20420070	NUT M 6
00604	20480168	FAN WASHER
00605	70054628	SPACER
00606	20510037	THREADED PIN
00607	20500122	PIN
00608	20140501	TEMP. SENSOR
00609	20270054	DELOMET 2301
00610	20240533	COMPRESSOR
00611	20430288	SCREW
00612	20480223	WASHER 8,4

Index	Partno.	Text
00613	20480254	SECURING WASHER
00614	20420078	NUT
00615	20240578	HIGH-PRESSURE CONTROLL SWITC
00620	20240356	CONDENSOR
00621	20430217	SCREW M6X16
00622	20480251	SECURING WASHER
00625	70055876	METAL SHEET
00626	20510252	SCREW 4,2X9,5
00630	20240487	FILTER DRYER
00631	20430250	SCREW
00633	20220134	CLAMP
00634	20260355	COUPLING NUT
00635	70052614	ANGLE SHEET
00636	20430258	SCREW M5X12
00637	20480135	WASHER
00638	20480167	FAN WASHER A 5,1
00639	20420077	HEXAGONAL NUT M5
00640	20210356	FAN
00641	70055616	BRACKET
00642	20480244	LOCK WASHER
00643	20460095	SCREW PHILIPS M4 X 10
00644	20510137	SCREW M 6 X 12
00645	20052555	ANTI VIBRATION MOUNT
00646	10104080	WASHER (SAND)
00649	20430250	SCREW
00655	20049373	BOTTLE
00656	20350187	SECURING SPRING
00657	20290364	HOSE
00658	20220160	HOSE CLIP
00660	20240396	COLLECTOR
00665	20240398	HEAT CHANGER
00670	20240485	INJECTION VALVE
00671	20240421	NOZZLE
00672	20260387	COUPLING NUT
00673	20240341	COUPLING NUT
00674	20290216	ARMAFLEX
00675	20290212	ARMAFLEX-HOSE
00676	20290291	HOSE ARMAFLEX

Index	Partno.	Text
00677	20270072	ISOLATION, TAPE
00680	20270100	FREON R 404 A

Spare-Part-List

Kendro Laboratory Products

Plant Osterode

75007520_04 CRYOFUGE 6000I 400V 3N 50HZ HI

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00100	70054651	FRONTPANEL
00101	20054686	Insulation
00102	10100209	TESA-MOLL
00110	20310260	KEY
00111	20310256	LOCK
00112	20310259	O-RING
00114	20310255	HOUSING
00115	20310258	SEAL
00117	20310323	HOOK
00118	20460095	SCREW PHILIPS M4 X 10
00120	20310261	HINGE
00121	20420077	HEXAGONAL NUT M5
00122	20480167	FAN WASHER A 5,1
00123	20480135	WASHER
00130	20430207	SCREW M 4 X 10
00131	20480108	FAN WASHER A 4,3
00132	20420076	HEXAGONAL NUT M4
00140	70054634	ANGLE
00141	20430216	SCREW M 6 X 12
00142	20480193	WASHER
00145	70054639	TRAVERSE
00146	20470089	SCREW M 5 X 10
00147	20480167	FAN WASHER A 5,1
00148	20420077	HEXAGONAL NUT M5
00150	20110261	HOUR COUNTER
00151	20540318	RC-COMBINATION
00152	20110262	CONTACTOR
00153	20110288	TEMP. RELAY
00160	20230196	FUSE HOLDER
00161	20230201	FUSE 20A
00165	20230165	Fuseholder
00166	20230199	FUSE 6A
00170	20220422	TERMINAL
00171	20220408	EARTH TERMINAL
00180	20907075	FOOT
00181	70054668	SCREW, ADJUSTABLE
00182	70054664	SECURITY DEVICE
00183	20420157	NUT

75007520_04 **CRYOFUGE 6000I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00184	20430258	SCREW M5X12
00185	20480167	FAN WASHER A 5,1
00200	70050952	HOUSING
00205	20049222	BOLT
00206	70050021	GRIP
00208	20460096	SCREW M5X10
00211	20480254	SECURING WASHER
00212	20430226	SCREW M 8 X 16
00221	20440212	SCREW M 5 X 10
00222	70907039	GROUNDING WIRE
00225	20907050	FRONTPANEL
00226	20180601	KEY SWITCH
00230	20150177	PCB DISPLAY
00235	70049526	SPACER
00240	20150117	INTERFACE V24 PCB
00241	20220489	SCREW COMPLETE
00250	70054630	BACKSIDE OF CONTROL PANEL
00254	20460090	SCREW M4X12
00255	20420076	HEXAGONAL NUT M4
00256	20480108	FAN WASHER A 4,3
00260	20310245	HINGE
00261	20460083	SCREW M 4 X 20
00262	20480244	LOCK WASHER
00263	20420076	HEXAGONAL NUT M4
00301	70054629	BACKPANEL
00302	20460085	SCREW M 5 X 12
00303	20250078	WASHER
00304	70054671	GRILL
00305	20180581	MAINS SWITCH
00306	20054663	THREADED PART
00307	20480157	WASHER
00308	20430215	SCREW M6X10
00309	20220472	PLASTIC RING
00310	70056259	Plate, inner
00311	20054650	FOIL
00312	20150118	PCB START-STOP
00313	70056253	Cover
00320	70900701	Benchtop

75007520_04 **CRYOFUGE 6000I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00322	20430221	SCREW M 6 X 30
00323	20430219	SCREW M 6 X 20
00324	20480157	WASHER
00325	20420070	NUT M 6
00326	20480251	SECURING WASHER
00327	20500179	Bar, threaded
00328	70049195	TERMINAL
00330	70056239	LID
00331	70056677	HANDLE PART
00332	20440286	SCREW M 4 X 10
00333	20056595	HOOK
00334	20420121	NUT M 10 X 1,25
00335	20480154	WASHER
00336	70049061	BEARING SUPPORT
00337	20440222	SCREW M6X20
00338	20049666	BOLT
00339	20480033	WASHER M8X0.8
00340	70054536	HINGE
00341	70054662	Spacer
00342	70056698	METALL SHEET
00343	20440310	SCREW
00344	20440311	SCREW
00345	20051304	WINDOW
00350	20310244	GAS LID STAY
00351	70907072	PLATE
00354	20480251	SECURING WASHER
00355	20430217	SCREW M6X16
00356	20049196	RUBBER PLATE
00360	70907575	LATCH, AUTOMATIC
00361	70056587	Bar, threaded
00362	70056593	ADAPTER, METAL LEFT
00363	70056594	ADAPTER, METAL
00364	20480251	SECURING WASHER
00365	70056596	Cover
00366	70056676	COVER PLATE
00370	20280123	CASTOR
00371	20430044	SCREW M8X20
00372	20480158	WASHER

75007520_04 **CRYOFUGE 6000I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00374	20420078	NUT
00375	20280124	CASTOR
00380	20054394	SPACER
00381	20480244	LOCK WASHER
00382	20460112	SCREW M 4 X 16
00383	20420076	HEXAGONAL NUT M4
00385	20220405	CABLE TIGHTENING
00386	20220453	LOCK NUT PG 21 M5
00387	20220459	CABLE PROTECTION
00390	70006709	MAINS CABLE
00393	70056696	Moulding
00394	70056697	Moulding
00395	20290644	SEAL
00400	20210327	MOTOR
00401	70907512	WIRING
00402	20190243	GROUNDING WIRE
00403	20430207	SCREW M 4 X 10
00404	20480108	FAN WASHER A 4,3
00405	20150102	SPEEDINDICATION
00406	20170316	FERROXCUBE
00407	20480242	SECURING WASHER
00408	20460098	SCREW M 3 X 6
00409	20170318	FERROXCUBE
00410	70054603	COVER-FLANGE
00411	20290541	FELT WASHER
00412	20470044	SCREW M 3 X 8
00415	20052927	WASHER
00416	20450081	SCREW M 5 X 55
00417	20049015	SPACER PIPE
00418	20052928	RUBBER FLANGE
00420	70054606	BASIS PLATE
00421	20054605	ANTIVIBRATION MOUNT
00422	10104080	WASHER (SAND)
00423	20510264	SCREW
00425	20430045	SCREW M8X25
00426	20480254	SECURING WASHER
00427	20480158	WASHER
00430	70054616	ANGLE

75007520_04 **CRYOFUGE 6000I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00431	20430216	SCREW M 6 X 12
00432	20480193	WASHER
00435	20180447	IMBALANCE SWITCH
00436	20180446	LEVER
00437	20460093	SCREW M 3 X 30
00438	20480242	SECURING WASHER
00440	70907505	WIRING, IMBALANCE
00450	20280119	WATER-LEVEL
00451	20034416	WRENCH
00452	20005492	BOX SPANNER 10 MM
00453	20360001	SPANNER 8MM
00454	20360008	SPANNER
00500	20150175	PCB 230V 50HZ
00501	20220482	SPACER
00502	20480244	LOCK WASHER
00503	20460095	SCREW PHILIPS M4 X 10
00505	70000599	MICROPROCESSOR
00506	70907571	NV RAM
00507	70907573	NV RAM
00510	20150104	INTERFERENCE BOARD
00520	20210345	FAN
00521	70054623	CHASSIS
00522	20460096	SCREW M5X10
00523	20510252	SCREW 4,2X9,5
00530	70907521	FAN
00531	70054636	CHASSIS FOR BRAKE FAN
00532	20460096	SCREW M5X10
00533	20480167	FAN WASHER A 5,1
00534	20510174	SCREW 3,5 X 6,5
00600	70907041	EVAPORATOR
00601	20056252	SEAL
00602	20480193	WASHER
00603	20420070	NUT M 6
00604	20480168	FAN WASHER
00605	70054628	SPACER
00606	20510037	THREADED PIN
00607	20500122	PIN
00608	20140501	TEMP. SENSOR

Index	Partno.	Text
00609	20270054	DELOMET 2301
00610	20240533	COMPRESSOR
00611	20430288	SCREW
00612	20480223	WASHER 8,4
00613	20480254	SECURING WASHER
00614	20420078	NUT
00615	20240578	HIGH-PRESSURE CONTROLL SWITC
00620	20240356	CONDENSOR
00621	20430217	SCREW M6X16
00622	20480251	SECURING WASHER
00625	70055876	METAL SHEET
00626	20510252	SCREW 4,2X9,5
00630	20240487	FILTER DRYER
00631	20430250	SCREW
00633	20220134	CLAMP
00634	20260355	COUPLING NUT
00635	70052614	ANGLE SHEET
00636	20430258	SCREW M5X12
00637	20480135	WASHER
00638	20480167	FAN WASHER A 5,1
00639	20420077	HEXAGONAL NUT M5
00640	20210356	FAN
00641	70055616	BRACKET
00642	20480244	LOCK WASHER
00643	20460095	SCREW PHILIPS M4 X 10
00644	20510137	SCREW M 6 X 12
00645	20052555	ANTI VIBRATION MOUNT
00646	10104080	WASHER (SAND)
00649	20430250	SCREW
00655	20049373	BOTTLE
00656	20350187	SECURING SPRING
00657	20290364	HOSE
00658	20220160	HOSE CLIP
00660	20240396	COLLECTOR
00665	20240398	HEAT CHANGER
00670	20240485	INJECTION VALVE
00671	20240421	NOZZLE
00672	20260387	COUPLING NUT

75007520_04 **CRYOFUGE 6000I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00673	20240341	COUPLING NUT
00674	20290216	ARMAFLEX
00675	20290212	ARMAFLEX-HOSE
00676	20290291	HOSE ARMAFLEX
00677	20270072	ISOLATION, TAPE
00680	20270100	FREON R 404 A

Spare-Part-List

Kendro Laboratory Products

Plant Osterode

75007521_03 CRYOFUGE 6000I 230V 3N 50/60HZ HI

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00100	70054651	FRONTPANEL
00101	20054686	Insulation
00102	10100209	TESA-MOLL
00110	20310260	KEY
00111	20310256	LOCK
00112	20310259	O-RING
00114	20310255	HOUSING
00115	20310258	SEAL
00117	20310323	HOOK
00118	20460095	SCREW PHILIPS M4 X 10
00120	20310261	HINGE
00121	20420077	HEXAGONAL NUT M5
00122	20480167	FAN WASHER A 5,1
00123	20480135	WASHER
00130	20430207	SCREW M 4 X 10
00131	20480108	FAN WASHER A 4,3
00132	20420076	HEXAGONAL NUT M4
00140	70055977	Angle
00141	20430216	SCREW M 6 X 12
00142	20480193	WASHER
00145	70055952	Traverse
00146	20470089	SCREW M 5 X 10
00147	20480167	FAN WASHER A 5,1
00148	20420077	HEXAGONAL NUT M5
00150	20110261	HOUR COUNTER
00151	20540318	RC-COMBINATION
00152	20110304	CONTACTOR
00153	20110309	THERMORELAY
00160	20230196	FUSE HOLDER
00161	20230201	FUSE 20A
00165	20230165	Fuseholder
00166	20230199	FUSE 6A
00171	20220408	EARTH TERMINAL
00180	20907075	FOOT
00181	70054668	SCREW, ADJUSTABLE
00182	70054664	SECURITY DEVICE
00183	20420157	NUT
00184	20430258	SCREW M5X12

Index	Partno.	Text
00185	20480167	FAN WASHER A 5,1
00200	70050952	HOUSING
00205	20049222	BOLT
00206	70050021	GRIP
00208	20460096	SCREW M5X10
00211	20480254	SECURING WASHER
00212	20430226	SCREW M 8 X 16
00221	20440212	SCREW M 5 X 10
00222	70907039	GROUNDING WIRE
00225	20907050	FRONTPANEL
00226	20180601	KEY SWITCH
00230	20150177	PCB DISPLAY
00235	70049526	SPACER
00240	20150117	INTERFACE V24 PCB
00241	20220489	SCREW COMPLETE
00250	70054630	BACKSIDE OF CONTROL PANEL
00254	20460090	SCREW M4X12
00255	20420076	HEXAGONAL NUT M4
00256	20480108	FAN WASHER A 4,3
00260	20310245	HINGE
00261	20460083	SCREW M 4 X 20
00262	20480244	LOCK WASHER
00263	20420076	HEXAGONAL NUT M4
00301	70054629	BACKPANEL
00302	20460085	SCREW M 5 X 12
00303	20250078	WASHER
00304	70054671	GRILL
00305	20180581	MAINS SWITCH
00306	20054663	THREADED PART
00307	20480157	WASHER
00308	20430215	SCREW M6X10
00309	20220472	PLASTIC RING
00310	70056259	Plate, inner
00311	20054650	FOIL
00312	20150118	PCB START-STOP
00313	70056253	Cover
00320	70900701	Benchtop
00322	20430221	SCREW M 6 X 30

Index	Partno.	Text
00323	20430219	SCREW M 6 X 20
00324	20480157	WASHER
00325	20420070	NUT M 6
00326	20480251	SECURING WASHER
00327	20500179	Bar, threaded
00328	70049195	TERMINAL
00330	70056239	LID
00331	70056677	HANDLE PART
00332	20440286	SCREW M 4 X 10
00333	20056595	HOOK
00334	20420121	NUT M 10 X 1,25
00335	20480154	WASHER
00336	70049061	BEARING SUPPORT
00337	20440222	SCREW M6X20
00338	20049666	BOLT
00339	20480033	WASHER M8X0.8
00340	70054536	HINGE
00341	70054662	Spacer
00342	70056698	METALL SHEET
00343	20440310	SCREW
00344	20440311	SCREW
00345	20051304	WINDOW
00350	20310244	GAS LID STAY
00351	70907072	PLATE
00354	20480251	SECURING WASHER
00355	20430217	SCREW M6X16
00356	20049196	RUBBER PLATE
00360	70907575	LATCH, AUTOMATIC
00361	70056587	Bar, threaded
00362	70056593	ADAPTER, METAL LEFT
00363	70056594	ADAPTER, METAL
00364	20480251	SECURING WASHER
00365	70056596	Cover
00366	70056676	COVER PLATE
00370	20280123	CASTOR
00371	20430044	SCREW M8X20
00372	20480158	WASHER
00374	20420078	NUT

Index	Partno.	Text
00375	20280124	CASTOR
00380	20054394	SPACER
00381	20480244	LOCK WASHER
00382	20460112	SCREW M 4 X 16
00383	20420076	HEXAGONAL NUT M4
00385	20220405	CABLE TIGHTENING
00386	20220453	LOCK NUT PG 21 M5
00387	20220406	CABLE SHEAT
00390	70907548	Mains cabel 230/3/PE
00393	70056696	Moulding
00394	70056697	Moulding
00395	20290644	SEAL
00400	20210327	MOTOR
00401	70907512	WIRING
00402	20190243	GROUNDING WIRE
00403	20430207	SCREW M 4 X 10
00404	20480108	FAN WASHER A 4,3
00405	20150102	SPEEDINDICATION
00406	20170316	FERROXCUBE
00407	20480242	SECURING WASHER
00408	20460098	SCREW M 3 X 6
00409	20170318	FERROXCUBE
00410	70054603	COVER-FLANGE
00411	20290541	FELT WASHER
00412	20470044	SCREW M 3 X 8
00415	20052927	WASHER
00416	20450081	SCREW M 5 X 55
00417	20049015	SPACER PIPE
00418	20052928	RUBBER FLANGE
00420	70054606	BASIS PLATE
00421	20054605	ANTIVIBRATION MOUNT
00422	10104080	WASHER (SAND)
00423	20510264	SCREW
00425	20430045	SCREW M8X25
00426	20480254	SECURING WASHER
00427	20480158	WASHER
00430	70054616	ANGLE
00431	20430216	SCREW M 6 X 12

Index	Partno.	Text
00432	20480193	WASHER
00435	20180447	IMBALANCE SWITCH
00436	20180446	LEVER
00437	20460093	SCREW M 3 X 30
00438	20480242	SECURING WASHER
00440	70907505	WIRING, IMBALANCE
00450	20280119	WATER-LEVEL
00451	20034416	WRENCH
00452	20005492	BOX SPANNER 10 MM
00453	20360001	SPANNER 8MM
00454	20360008	SPANNER
00500	20150175	PCB 230V 50HZ
00501	20220482	SPACER
00502	20480244	LOCK WASHER
00503	20460095	SCREW PHILIPS M4 X 10
00505	70000599	MICROPROCESSOR
00506	70907571	NV RAM
00507	70907573	NV RAM
00510	20150104	INTERFERENCE BOARD
00520	20210345	FAN
00521	70054623	CHASSIS
00522	20460096	SCREW M5X10
00523	20510252	SCREW 4,2X9,5
00530	70907521	FAN
00531	70054636	CHASSIS FOR BRAKE FAN
00532	20460096	SCREW M5X10
00533	20480167	FAN WASHER A 5,1
00534	20510174	SCREW 3,5 X 6,5
00600	70907041	EVAPORATOR
00601	20056252	SEAL
00602	20480193	WASHER
00603	20420070	NUT M 6
00604	20480168	FAN WASHER
00605	70054628	SPACER
00606	20510037	THREADED PIN
00607	20500122	PIN
00608	20140501	TEMP. SENSOR
00609	20270054	DELOMET 2301

75007521_03 CRYOFUGE 6000I 230V 3N 50/60HZ HI

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00610	20240595	COMPRESSOR
00611	20430288	SCREW
00612	20480223	WASHER 8,4
00613	20480254	SECURING WASHER
00614	20420078	NUT
00615	20240578	HIGH-PRESSURE CONTROLL SWITC
00620	20240356	CONDENSOR
00621	20430217	SCREW M6X16
00622	20480251	SECURING WASHER
00625	70055876	METAL SHEET
00626	20510252	SCREW 4,2X9,5
00630	20240487	FILTER DRYER
00631	20430250	SCREW
00633	20220134	CLAMP
00634	20260355	COUPLING NUT
00635	70052614	ANGLE SHEET
00636	20430258	SCREW M5X12
00637	20480135	WASHER
00638	20480167	FAN WASHER A 5,1
00639	20420077	HEXAGONAL NUT M5
00640	20210356	FAN
00641	70055616	BRACKET
00642	20480244	LOCK WASHER
00643	20460095	SCREW PHILIPS M4 X 10
00644	20510137	SCREW M 6 X 12
00645	20052555	ANTI VIBRATION MOUNT
00646	10104080	WASHER (SAND)
00649	20430250	SCREW
00655	20049373	BOTTLE
00656	20350187	SECURING SPRING
00657	20290364	HOSE
00658	20220160	HOSE CLIP
00660	20240396	COLLECTOR
00665	20240398	HEAT CHANGER
00670	20240485	INJECTION VALVE
00671	20240421	NOZZLE
00672	20260387	COUPLING NUT
00673	20240341	COUPLING NUT

75007521_03 CRYOFUGE 6000I 230V 3N 50/60HZ HI

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00674	20290216	ARMAFLEX
00675	20290212	ARMAFLEX-HOSE
00676	20290291	HOSE ARMAFLEX
00677	20270072	ISOLATION, TAPE
00680	20270100	FREON R 404 A

Spare-Part-List

Kendro Laboratory Products

Plant Osterode

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from Serial-No. 275450 **to Serial-No.**

Index	Partno.	Text
00100	70054651	FRONTPANEL
00101	20049480	DAMPER
00102	10100209	TESA-MOLL
00111	20310256	LOCK
00112	20310259	O-RING
00114	20310255	HOUSING
00115	20310258	SEAL
00117	20310323	HOOK
00118	20460095	SCREW PHILIPS M4 X 10
00120	20310261	HINGE
00121	20420077	HEXAGONAL NUT M5
00122	20480167	FAN WASHER A 5,1
00123	20480135	WASHER
00130	20430207	SCREW M 4 X 10
00131	20480108	FAN WASHER A 4,3
00132	20420076	HEXAGONAL NUT M4
00140	70054634	ANGLE
00141	20430216	SCREW M 6 X 12
00142	20480193	WASHER
00145	70054639	TRAVERSE
00146	20470089	SCREW M 5 X 10
00147	20480167	FAN WASHER A 5,1
00148	20420077	HEXAGONAL NUT M5
00150	20110261	HOUR COUNTER
00151	20540318	RC-COMBINATION
00152	20110304	CONTACTOR
00153	20110282	TEMP. RELAY
00160	20230196	FUSE HOLDER
00161	20230201	FUSE 20A
00165	20230165	Fuseholder
00166	20230199	FUSE 6A
00170	20220422	TERMINAL
00171	20220408	EARTH TERMINAL
00180	20907075	FOOT
00181	70054668	SCREW, ADJUSTABLE
00182	70054664	SECURITY DEVICE
00183	20420157	NUT
00185	20480167	FAN WASHER A 5,1

75007526_02 CRYOFUGE 6000I 230V 50HZ HI

from Serial-No. 275450 **to Serial-No.**

Index	Partno.	Text
00200	70050952	HOUSING
00205	20049222	BOLT
00206	70050021	GRIP
00208	20460096	SCREW M5X10
00211	20480254	SECURING WASHER
00212	20430226	SCREW M 8 X 16
00221	20440212	SCREW M 5 X 10
00222	70907039	GROUNDING WIRE
00225	20907050	FRONTPANEL
00226	20180601	KEY SWITCH
00230	20150177	PCB DISPLAY
00235	70049526	SPACER
00240	20150117	INTERFACE V24 PCB
00241	20220489	SCREW COMPLETE
00250	70054630	BACKSIDE OF CONTROL PANEL
00260	20310245	HINGE
00301	70054629	BACKPANEL
00302	20460085	SCREW M 5 X 12
00303	20250078	WASHER
00304	70054671	GRILL
00305	20180581	MAINS SWITCH
00306	20054663	THREADED PART
00307	20480157	WASHER
00308	20430215	SCREW M6X10
00309	20220472	PLASTIC RING
00310	70056253	Cover
00311	20054650	FOIL
00312	20150118	PCB START-STOP
00313	70056259	Plate, inner
00320	70900701	Benchtop
00323	20430219	SCREW M 6 X 20
00324	20480157	WASHER
00325	20420070	NUT M 6
00326	20480244	LOCK WASHER
00327	20500179	Bar, threaded
00328	70049195	TERMINAL
00330	70056239	LID
00331	70056677	HANDLE PART

75007526_02 **CRYOFUGE 6000I 230V 50HZ HI**

from Serial-No. 275450 **to Serial-No.**

Index	Partno.	Text
00332	20440286	SCREW M 4 X 10
00333	20056595	HOOK
00334	20420121	NUT M 10 X 1,25
00336	70049061	BEARING SUPPORT
00337	20440222	SCREW M6X20
00338	20049666	BOLT
00339	20480033	WASHER M8X0.8
00340	70054662	Spacer
00341	70054662	Spacer
00342	70056698	METALL SHEET
00343	20440310	SCREW
00344	20440311	SCREW
00345	70056696	Moulding
00346	70056697	Moulding
00347	20051304	WINDOW
00350	20310244	GAS LID STAY
00356	20049196	RUBBER PLATE
00360	70907575	LATCH, AUTOMATIC
00361	70056587	Bar, threaded
00362	70056593	ADAPTER, METAL LEFT
00363	70056594	ADAPTER, METAL
00365	70056676	COVER PLATE
00366	20440298	SCREW M4X12
00366	70056596	Cover
00370	20280123	CASTOR
00375	20280124	CASTOR
00380	20054394	SPACER
00381	20480244	LOCK WASHER
00382	20460112	SCREW M 4 X 16
00383	20420076	HEXAGONAL NUT M4
00385	20220405	CABLE TIGHTENING
00386	20220453	LOCK NUT PG 21 M5
00387	20220406	CABLE SHEAT
00400	20210327	MOTOR
00401	70907512	WIRING
00402	20190243	GROUNDING WIRE
00403	20430207	SCREW M 4 X 10
00404	20480108	FAN WASHER A 4,3

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from Serial-No. 275450 **to Serial-No.**

Index	Partno.	Text
00405	20150102	SPEEDINDICATION
00406	20170316	FERROXCUBE
00407	20480242	SECURING WASHER
00408	20460098	SCREW M 3 X 6
00409	20170318	FERROXCUBE
00410	70054603	COVER-FLANGE
00411	20290541	FELT WASHER
00412	20470044	SCREW M 3 X 8
00415	20052927	WASHER
00416	20450081	SCREW M 5 X 55
00417	20049015	SPACER PIPE
00418	20052928	RUBBER FLANGE
00420	70054606	BASIS PLATE
00421	20054605	ANTIVIBRATION MOUNT
00422	10104080	WASHER (SAND)
00423	20510264	SCREW
00425	20430045	SCREW M8X25
00426	20480254	SECURING WASHER
00427	20480158	WASHER
00430	70054616	ANGLE
00431	20430216	SCREW M 6 X 12
00432	20480251	SECURING WASHER
00435	20180447	IMBALANCE SWITCH
00436	20180446	LEVER
00437	20460108	SCREW
00438	20480244	LOCK WASHER
00439	20420076	HEXAGONAL NUT M4
00440	70907505	WIRING, IMBALANCE
00500	20150175	PCB 230V 50HZ
00501	20220482	SPACER
00502	20480244	LOCK WASHER
00503	20460095	SCREW PHILIPS M4 X 10
00505	70000599	MICROPROCESSOR
00506	70907571	NV RAM
00507	70907573	NV RAM
00510	20150104	INTERFERENCE BOARD
00520	20210345	FAN
00521	70054623	CHASSIS

75007526_02 **CRYOFUGE 6000I 230V 50HZ HI**

from Serial-No. 275450 **to Serial-No.**

Index	Partno.	Text
00522	20460096	SCREW M5X10
00523	20510252	SCREW 4,2X9,5
00530	70907521	FAN
00531	70054636	CHASSIS FOR BRAKE FAN
00532	20460096	SCREW M5X10
00533	20480167	FAN WASHER A 5,1
00534	20510245	SCREW 4,2 X 9,5
00600	70907041	EVAPORATOR
00601	20056252	SEAL
00602	20480193	WASHER
00603	20420070	NUT M 6
00604	20480251	SECURING WASHER
00605	70054628	SPACER
00606	20510037	THREADED PIN
00607	20500122	PIN
00608	20140501	TEMP. SENSOR
00609	20270054	DELOMET 2301
00610	20240482	COMPRESSOR
00611	20430288	SCREW
00613	20480254	SECURING WASHER
00614	20420078	NUT
00615	70907509	HIGH PRESSURE CONTROL
00620	20240356	CONDENSOR
00621	20430217	SCREW M6X16
00622	20480251	SECURING WASHER
00625	70055876	METAL SHEET
00626	20510245	SCREW 4,2 X 9,5
00630	20240487	FILTER DRYER
00634	20260355	COUPLING NUT
00640	20210356	FAN
00641	70055616	BRACKET
00642	20480244	LOCK WASHER
00643	20460095	SCREW PHILIPS M4 X 10
00644	20510137	SCREW M 6 X 12
00645	20052555	ANTI VIBRATION MOUNT
00646	10104080	WASHER (SAND)
00649	20430250	SCREW
00655	20049373	BOTTLE

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from Serial-No. 275450 **to Serial-No.**

Index	Partno.	Text
00656	20350187	SECURING SPRING
00657	20290364	HOSE
00658	20220160	HOSE CLIP
00660	20240396	COLLECTOR
00664	20430216	SCREW M 6 X 12
00665	20240401	HEAT EXCHANGER
00666	20220527	CLAMP
00667	70056119	BRACKET
00668	20480249	LOCK WASHER
00669	20430040	SCREW M8X10
00670	20240485	INJECTION VALVE
00671	20240421	NOZZLE
00672	20260387	COUPLING NUT
00673	20240341	COUPLING NUT
00674	20290216	ARMAFLEX
00675	20290212	ARMAFLEX-HOSE
00676	20290291	HOSE ARMAFLEX
00677	20270072	ISOLATION, TAPE
00680	20270100	FREON R 404 A

Spare-Part-List

Kendro Laboratory Products

Plant Osterode

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from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00100	70054652	FRONTPANEL
00101	20054686	Insulation
00102	10100209	TESA-MOLL
00110	20310260	KEY
00111	20310256	LOCK
00112	20310259	O-RING
00114	20310255	HOUSING
00115	20310258	SEAL
00117	20310323	HOOK
00118	20460095	SCREW PHILIPS M4 X 10
00120	20310261	HINGE
00121	20420077	HEXAGONAL NUT M5
00122	20480167	FAN WASHER A 5,1
00123	20480135	WASHER
00130	20430207	SCREW M 4 X 10
00131	20480108	FAN WASHER A 4,3
00132	20420076	HEXAGONAL NUT M4
00140	70054634	ANGLE
00141	20430216	SCREW M 6 X 12
00142	20480193	WASHER
00145	70054639	TRAVERSE
00146	20470089	SCREW M 5 X 10
00147	20480167	FAN WASHER A 5,1
00148	20420077	HEXAGONAL NUT M5
00150	20110261	HOUR COUNTER
00151	20540318	RC-COMBINATION
00152	20110262	CONTACTOR
00153	20110288	TEMP. RELAY
00160	20230196	FUSE HOLDER
00161	20230201	FUSE 20A
00165	20230165	Fuseholder
00166	20230199	FUSE 6A
00170	20220422	TERMINAL
00171	20220408	EARTH TERMINAL
00180	20907075	FOOT
00181	70054668	SCREW, ADJUSTABLE
00182	70054664	SECURITY DEVICE
00183	20420157	NUT

75007550_03 **CRYOFUGE 8500I 400V 3N 50HZ HI**

from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00184	20430258	SCREW M5X12
00185	20480167	FAN WASHER A 5,1
00200	70050952	HOUSING
00205	20049222	BOLT
00206	70050021	GRIP
00208	20460096	SCREW M5X10
00211	20480254	SECURING WASHER
00212	20430226	SCREW M 8 X 16
00221	20440212	SCREW M 5 X 10
00222	70907039	GROUNDING WIRE
00225	20907050	FRONTPANEL
00226	20180601	KEY SWITCH
00230	20150177	PCB DISPLAY
00235	70049526	SPACER
00240	20150117	INTERFACE V24 PCB
00241	20220489	SCREW COMPLETE
00250	70054630	BACKSIDE OF CONTROL PANEL
00254	20460090	SCREW M4X12
00255	20420076	HEXAGONAL NUT M4
00256	20480108	FAN WASHER A 4,3
00260	20310245	HINGE
00261	20460083	SCREW M 4 X 20
00262	20480244	LOCK WASHER
00263	20420076	HEXAGONAL NUT M4
00301	70054629	BACKPANEL
00302	20460085	SCREW M 5 X 12
00303	20250078	WASHER
00304	70054671	GRILL
00305	20180581	MAINS SWITCH
00306	20054663	THREADED PART
00307	20480157	WASHER
00308	20430215	SCREW M6X10
00309	20220472	PLASTIC RING
00310	70056259	Plate, inner
00311	20054650	FOIL
00312	20150118	PCB START-STOP
00313	70056253	Cover
00320	70900701	Benchtop

75007550_03 **CRYOFUGE 8500I 400V 3N 50HZ HI**

from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00322	20430221	SCREW M 6 X 30
00323	20430219	SCREW M 6 X 20
00324	20480157	WASHER
00325	20420070	NUT M 6
00326	20480251	SECURING WASHER
00327	20500179	Bar, threaded
00328	70049195	TERMINAL
00330	70056239	LID
00331	70056677	HANDLE PART
00332	20440286	SCREW M 4 X 10
00333	20052842	LID HOOK
00334	20420121	NUT M 10 X 1,25
00335	20480154	WASHER
00336	70049061	BEARING SUPPORT
00337	20440222	SCREW M6X20
00338	20049666	BOLT
00339	20480033	WASHER M8X0.8
00340	70054536	HINGE
00341	70054662	Spacer
00343	20440310	SCREW
00344	20440311	SCREW
00345	20051304	WINDOW
00350	20310244	GAS LID STAY
00351	70907072	PLATE
00354	20480251	SECURING WASHER
00355	20430217	SCREW M6X16
00356	20049196	RUBBER PLATE
00360	70003700	LID LOCK ASSY
00361	70051113	FIXING PLATE
00362	70053560	FIXING PLATE
00363	20510077	SCREW M 6 X 20
00364	20480157	WASHER
00365	70056253	Cover
00366	70056253	Cover
00370	20280123	CASTOR
00371	20430044	SCREW M8X20
00372	20480158	WASHER
00374	20420078	NUT

75007550_03 **CRYOFUGE 8500I 400V 3N 50HZ HI**

from Serial-No. 238182 **to Serial-No. 272981**

Index	Partno.	Text
00375	20280124	CASTOR
00380	20054394	SPACER
00381	20480244	LOCK WASHER
00382	20460112	SCREW M 4 X 16
00383	20420076	HEXAGONAL NUT M4
00385	20220405	CABLE TIGHTENING
00386	20220453	LOCK NUT PG 21 M5
00387	20220459	CABLE PROTECTION
00390	70006709	MAINS CABLE
00400	20210327	MOTOR
00401	70907512	WIRING
00402	20190243	GROUNDING WIRE
00403	20430207	SCREW M 4 X 10
00404	20480108	FAN WASHER A 4,3
00405	20150102	SPEEDINDICATION
00406	20170316	FERROXCUBE
00407	20480242	SECURING WASHER
00408	20460098	SCREW M 3 X 6
00409	20170318	FERROXCUBE
00410	70054603	COVER-FLANGE
00411	20290541	FELT WASHER
00412	20470044	SCREW M 3 X 8
00415	20052927	WASHER
00416	20450081	SCREW M 5 X 55
00417	20049015	SPACER PIPE
00418	20052928	RUBBER FLANGE
00420	70054606	BASIS PLATE
00421	20054605	ANTIVIBRATION MOUNT
00422	10104080	WASHER (SAND)
00423	20510264	SCREW
00425	20430045	SCREW M8X25
00426	20480254	SECURING WASHER
00427	20480158	WASHER
00430	70054616	ANGLE
00431	20430216	SCREW M 6 X 12
00432	20480193	WASHER
00435	20180447	IMBALANCE SWITCH
00436	20180446	LEVER

Index	Partno.	Text
00437	20460093	SCREW M 3 X 30
00438	20480242	SECURING WASHER
00440	70907505	WIRING, IMBALANCE
00450	20280119	WATER-LEVEL
00451	20034416	WRENCH
00452	20005492	BOX SPANNER 10 MM
00453	20360001	SPANNER 8MM
00454	20360008	SPANNER
00500	20150175	PCB 230V 50HZ
00501	20220482	SPACER
00502	20480244	LOCK WASHER
00503	20460095	SCREW PHILIPS M4 X 10
00505	70000498	PROCESSOR
00506	70907535	EEPROM
00507	70907556	EEPROM
00510	20150104	INTERFERENCE BOARD
00520	20210345	FAN
00521	70054623	CHASSIS
00522	20460096	SCREW M5X10
00523	20510252	SCREW 4,2X9,5
00530	70907521	FAN
00531	70054636	CHASSIS FOR BRAKE FAN
00532	20460096	SCREW M5X10
00533	20480167	FAN WASHER A 5,1
00534	20510174	SCREW 3,5 X 6,5
00600	70907041	EVAPORATOR
00601	20056252	SEAL
00602	20480193	WASHER
00603	20420070	NUT M 6
00604	20480168	FAN WASHER
00605	70054628	SPACER
00606	20510037	THREADED PIN
00607	20500122	PIN
00608	20140501	TEMP. SENSOR
00609	20270054	DELOMET 2301
00610	20240533	COMPRESSOR
00611	20430288	SCREW
00612	20480223	WASHER 8,4

Index	Partno.	Text
00613	20480254	SECURING WASHER
00614	20420078	NUT
00615	20240578	HIGH-PRESSURE CONTROLL SWITC
00620	20240356	CONDENSOR
00621	20430217	SCREW M6X16
00622	20480251	SECURING WASHER
00625	70055876	METAL SHEET
00626	20510252	SCREW 4,2X9,5
00630	20240487	FILTER DRYER
00631	20430250	SCREW
00633	20220134	CLAMP
00634	20260355	COUPLING NUT
00635	70052614	ANGLE SHEET
00636	20430258	SCREW M5X12
00637	20480135	WASHER
00638	20480167	FAN WASHER A 5,1
00639	20420077	HEXAGONAL NUT M5
00640	20210356	FAN
00641	70055616	BRACKET
00642	20480244	LOCK WASHER
00643	20460095	SCREW PHILIPS M4 X 10
00644	20510137	SCREW M 6 X 12
00645	20052555	ANTI VIBRATION MOUNT
00646	10104080	WASHER (SAND)
00649	20430250	SCREW
00655	20049373	BOTTLE
00656	20350187	SECURING SPRING
00657	20290364	HOSE
00658	20220160	HOSE CLIP
00660	20240396	COLLECTOR
00665	20240398	HEAT CHANGER
00670	20240485	INJECTION VALVE
00671	20240421	NOZZLE
00672	20260387	COUPLING NUT
00673	20240341	COUPLING NUT
00674	20290216	ARMAFLEX
00675	20290212	ARMAFLEX-HOSE
00676	20290291	HOSE ARMAFLEX

Index	Partno.	Text
00677	20270072	ISOLATION, TAPE
00680	20270100	FREON R 404 A

Spare-Part-List

Kendro Laboratory Products

Plant Osterode

75007550_04 CRYOFUGE 8500I 400V 3N 50HZ HI

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00100	70054652	FRONTPANEL
00101	20054686	Insulation
00102	10100209	TESA-MOLL
00110	20310260	KEY
00111	20310256	LOCK
00112	20310259	O-RING
00114	20310255	HOUSING
00115	20310258	SEAL
00117	20310323	HOOK
00118	20460095	SCREW PHILIPS M4 X 10
00120	20310261	HINGE
00121	20420077	HEXAGONAL NUT M5
00122	20480167	FAN WASHER A 5,1
00123	20480135	WASHER
00130	20430207	SCREW M 4 X 10
00131	20480108	FAN WASHER A 4,3
00132	20420076	HEXAGONAL NUT M4
00140	70054634	ANGLE
00141	20430216	SCREW M 6 X 12
00142	20480193	WASHER
00145	70054639	TRAVERSE
00146	20470089	SCREW M 5 X 10
00147	20480167	FAN WASHER A 5,1
00148	20420077	HEXAGONAL NUT M5
00150	20110261	HOUR COUNTER
00151	20540318	RC-COMBINATION
00152	20110262	CONTACTOR
00153	20110288	TEMP. RELAY
00160	20230196	FUSE HOLDER
00161	20230201	FUSE 20A
00165	20230165	Fuseholder
00166	20230199	FUSE 6A
00170	20220422	TERMINAL
00171	20220408	EARTH TERMINAL
00180	20907075	FOOT
00181	70054668	SCREW, ADJUSTABLE
00182	70054664	SECURITY DEVICE
00183	20420157	NUT

75007550_04 **CRYOFUGE 8500I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00184	20430258	SCREW M5X12
00185	20480167	FAN WASHER A 5,1
00200	70050952	HOUSING
00205	20049222	BOLT
00206	70050021	GRIP
00208	20460096	SCREW M5X10
00211	20480254	SECURING WASHER
00212	20430226	SCREW M 8 X 16
00221	20440212	SCREW M 5 X 10
00222	70907039	GROUNDING WIRE
00225	20907050	FRONTPANEL
00226	20180601	KEY SWITCH
00230	20150177	PCB DISPLAY
00235	70049526	SPACER
00240	20150117	INTERFACE V24 PCB
00241	20220489	SCREW COMPLETE
00250	70054630	BACKSIDE OF CONTROL PANEL
00254	20460090	SCREW M4X12
00255	20420076	HEXAGONAL NUT M4
00256	20480108	FAN WASHER A 4,3
00260	20310245	HINGE
00261	20460083	SCREW M 4 X 20
00262	20480244	LOCK WASHER
00263	20420076	HEXAGONAL NUT M4
00301	70054629	BACKPANEL
00302	20460085	SCREW M 5 X 12
00303	20250078	WASHER
00304	70054671	GRILL
00305	20180581	MAINS SWITCH
00306	20054663	THREADED PART
00307	20480157	WASHER
00308	20430215	SCREW M6X10
00309	20220472	PLASTIC RING
00310	70056259	Plate, inner
00311	20054650	FOIL
00312	20150118	PCB START-STOP
00313	70056253	Cover
00320	70900701	Benchtop

75007550_04 CRYOFUGE 8500I 400V 3N 50HZ HI

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00322	20430221	SCREW M 6 X 30
00323	20430219	SCREW M 6 X 20
00324	20480157	WASHER
00325	20420070	NUT M 6
00326	20480251	SECURING WASHER
00327	20500179	Bar, threaded
00328	70049195	TERMINAL
00330	70056239	LID
00331	70056677	HANDLE PART
00332	20440286	SCREW M 4 X 10
00333	20056595	HOOK
00334	20420121	NUT M 10 X 1,25
00335	20480154	WASHER
00336	70049061	BEARING SUPPORT
00337	20440222	SCREW M6X20
00338	20049666	BOLT
00339	20480033	WASHER M8X0.8
00340	70054536	HINGE
00341	70054662	Spacer
00342	70056698	METALL SHEET
00343	20440310	SCREW
00344	20440311	SCREW
00345	20051304	WINDOW
00350	20310244	GAS LID STAY
00351	70907072	PLATE
00354	20480251	SECURING WASHER
00355	20430217	SCREW M6X16
00356	20049196	RUBBER PLATE
00360	70907575	LATCH, AUTOMATIC
00361	70056587	Bar, threaded
00362	70056593	ADAPTER, METAL LEFT
00363	70056594	ADAPTER, METAL
00364	20480251	SECURING WASHER
00365	70056596	Cover
00366	70056676	COVER PLATE
00370	20280123	CASTOR
00371	20430044	SCREW M8X20
00372	20480158	WASHER

75007550_04 **CRYOFUGE 8500I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00374	20420078	NUT
00375	20280124	CASTOR
00380	20054394	SPACER
00381	20480244	LOCK WASHER
00382	20460112	SCREW M 4 X 16
00383	20420076	HEXAGONAL NUT M4
00385	20220405	CABLE TIGHTENING
00386	20220453	LOCK NUT PG 21 M5
00387	20220459	CABLE PROTECTION
00390	70006709	MAINS CABLE
00393	70056696	Moulding
00394	70056697	Moulding
00395	20290644	SEAL
00400	20210327	MOTOR
00401	70907512	WIRING
00402	20190243	GROUNDING WIRE
00403	20430207	SCREW M 4 X 10
00404	20480108	FAN WASHER A 4,3
00405	20150102	SPEEDINDICATION
00406	20170316	FERROXCUBE
00407	20480242	SECURING WASHER
00408	20460098	SCREW M 3 X 6
00409	20170318	FERROXCUBE
00410	70054603	COVER-FLANGE
00411	20290541	FELT WASHER
00412	20470044	SCREW M 3 X 8
00415	20052927	WASHER
00416	20450081	SCREW M 5 X 55
00417	20049015	SPACER PIPE
00418	20052928	RUBBER FLANGE
00420	70054606	BASIS PLATE
00421	20054605	ANTIVIBRATION MOUNT
00422	10104080	WASHER (SAND)
00423	20510264	SCREW
00425	20430045	SCREW M8X25
00426	20480254	SECURING WASHER
00427	20480158	WASHER
00430	70054616	ANGLE

75007550_04 CRYOFUGE 8500I 400V 3N 50HZ HI

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00431	20430216	SCREW M 6 X 12
00432	20480193	WASHER
00435	20180447	IMBALANCE SWITCH
00436	20180446	LEVER
00437	20460093	SCREW M 3 X 30
00438	20480242	SECURING WASHER
00440	70907505	WIRING, IMBALANCE
00450	20280119	WATER-LEVEL
00451	20034416	WRENCH
00452	20005492	BOX SPANNER 10 MM
00453	20360001	SPANNER 8MM
00454	20360008	SPANNER
00500	20150175	PCB 230V 50HZ
00501	20220482	SPACER
00502	20480244	LOCK WASHER
00503	20460095	SCREW PHILIPS M4 X 10
00505	70000599	MICROPROCESSOR
00506	70907572	
00507	70907573	NV RAM
00510	20150104	INTERFERENCE BOARD
00520	20210345	FAN
00521	70054623	CHASSIS
00522	20460096	SCREW M5X10
00523	20510252	SCREW 4,2X9,5
00530	70907521	FAN
00531	70054636	CHASSIS FOR BRAKE FAN
00532	20460096	SCREW M5X10
00533	20480167	FAN WASHER A 5,1
00534	20510174	SCREW 3,5 X 6,5
00600	70907041	EVAPORATOR
00601	20056252	SEAL
00602	20480193	WASHER
00603	20420070	NUT M 6
00604	20480168	FAN WASHER
00605	70054628	SPACER
00606	20510037	THREADED PIN
00607	20500122	PIN
00608	20140501	TEMP. SENSOR

75007550_04 **CRYOFUGE 8500I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00609	20270054	DELOMET 2301
00610	20240533	COMPRESSOR
00611	20430288	SCREW
00612	20480223	WASHER 8,4
00613	20480254	SECURING WASHER
00614	20420078	NUT
00615	20240578	HIGH-PRESSURE CONTROLL SWITC
00620	20240356	CONDENSOR
00621	20430217	SCREW M6X16
00622	20480251	SECURING WASHER
00625	70055876	METAL SHEET
00626	20510252	SCREW 4,2X9,5
00630	20240487	FILTER DRYER
00631	20430250	SCREW
00633	20220134	CLAMP
00634	20260355	COUPLING NUT
00635	70052614	ANGLE SHEET
00636	20430258	SCREW M5X12
00637	20480135	WASHER
00638	20480167	FAN WASHER A 5,1
00639	20420077	HEXAGONAL NUT M5
00640	20210356	FAN
00641	70055616	BRACKET
00642	20480244	LOCK WASHER
00643	20460095	SCREW PHILIPS M4 X 10
00644	20510137	SCREW M 6 X 12
00645	20052555	ANTI VIBRATION MOUNT
00646	10104080	WASHER (SAND)
00649	20430250	SCREW
00655	20049373	BOTTLE
00656	20350187	SECURING SPRING
00657	20290364	HOSE
00658	20220160	HOSE CLIP
00660	20240396	COLLECTOR
00665	20240398	HEAT CHANGER
00670	20240485	INJECTION VALVE
00671	20240421	NOZZLE
00672	20260387	COUPLING NUT

75007550_04 **CRYOFUGE 8500I 400V 3N 50HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00673	20240341	COUPLING NUT
00674	20290216	ARMAFLEX
00675	20290212	ARMAFLEX-HOSE
00676	20290291	HOSE ARMAFLEX
00677	20270072	ISOLATION, TAPE
00680	20270100	FREON R 404 A

Spare-Part-List

Kendro Laboratory Products

Plant Osterode

75007551_03 CRYOFUGE 8500I 230V/3/50-60HZ HI

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00100	70054652	FRONTPANEL
00101	20054686	Insulation
00102	10100209	TESA-MOLL
00110	20310260	KEY
00111	20310256	LOCK
00112	20310259	O-RING
00114	20310255	HOUSING
00115	20310258	SEAL
00117	20310323	HOOK
00118	20460095	SCREW PHILIPS M4 X 10
00120	20310261	HINGE
00121	20420077	HEXAGONAL NUT M5
00122	20480167	FAN WASHER A 5,1
00123	20480135	WASHER
00130	20430207	SCREW M 4 X 10
00131	20480108	FAN WASHER A 4,3
00132	20420076	HEXAGONAL NUT M4
00140	70055977	Angle
00141	20430216	SCREW M 6 X 12
00142	20480193	WASHER
00145	70055952	Traverse
00146	20470089	SCREW M 5 X 10
00147	20480167	FAN WASHER A 5,1
00148	20420077	HEXAGONAL NUT M5
00150	20110261	HOUR COUNTER
00151	20540318	RC-COMBINATION
00152	20110304	CONTACTOR
00153	20110309	THERMORELAY
00160	20230196	FUSE HOLDER
00161	20230201	FUSE 20A
00165	20230165	Fuseholder
00166	20230199	FUSE 6A
00171	20220408	EARTH TERMINAL
00180	20907075	FOOT
00181	70054668	SCREW, ADJUSTABLE
00182	70054664	SECURITY DEVICE
00183	20420157	NUT
00184	20430258	SCREW M5X12

75007551_03 **CRYOFUGE 8500I 230V/3/50-60HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00185	20480167	FAN WASHER A 5,1
00200	70050952	HOUSING
00205	20049222	BOLT
00206	70050021	GRIP
00208	20460096	SCREW M5X10
00211	20480254	SECURING WASHER
00212	20430226	SCREW M 8 X 16
00221	20440212	SCREW M 5 X 10
00222	70907039	GROUNDING WIRE
00225	20907050	FRONTPANEL
00226	20180601	KEY SWITCH
00230	20150177	PCB DISPLAY
00235	70049526	SPACER
00240	20150117	INTERFACE V24 PCB
00241	20220489	SCREW COMPLETE
00250	70054630	BACKSIDE OF CONTROL PANEL
00254	20460090	SCREW M4X12
00255	20420076	HEXAGONAL NUT M4
00256	20480108	FAN WASHER A 4,3
00260	20310245	HINGE
00261	20460083	SCREW M 4 X 20
00262	20480244	LOCK WASHER
00263	20420076	HEXAGONAL NUT M4
00301	70054629	BACKPANEL
00302	20460085	SCREW M 5 X 12
00303	20250078	WASHER
00304	70054671	GRILL
00305	20180581	MAINS SWITCH
00306	20054663	THREADED PART
00307	20480157	WASHER
00308	20430215	SCREW M6X10
00309	20220472	PLASTIC RING
00310	70056259	Plate, inner
00311	20054650	FOIL
00312	20150118	PCB START-STOP
00313	70056253	Cover
00320	70900701	Benchtop
00322	20430221	SCREW M 6 X 30

Index	Partno.	Text
00323	20430219	SCREW M 6 X 20
00324	20480157	WASHER
00325	20420070	NUT M 6
00326	20480251	SECURING WASHER
00327	20500179	Bar, threaded
00328	70049195	TERMINAL
00330	70056239	LID
00331	70056677	HANDLE PART
00332	20440286	SCREW M 4 X 10
00333	20056595	HOOK
00334	20420121	NUT M 10 X 1,25
00335	20480154	WASHER
00336	70049061	BEARING SUPPORT
00337	20440222	SCREW M6X20
00338	20049666	BOLT
00339	20480033	WASHER M8X0.8
00340	70054536	HINGE
00341	70054662	Spacer
00342	70056698	METALL SHEET
00343	20440310	SCREW
00344	20440311	SCREW
00345	20051304	WINDOW
00350	20310244	GAS LID STAY
00351	70907072	PLATE
00354	20480251	SECURING WASHER
00355	20430217	SCREW M6X16
00356	20049196	RUBBER PLATE
00360	70907575	LATCH, AUTOMATIC
00361	70056587	Bar, threaded
00362	70056593	ADAPTER, METAL LEFT
00363	70056594	ADAPTER, METAL
00364	20480251	SECURING WASHER
00365	70056596	Cover
00366	70056676	COVER PLATE
00370	20280123	CASTOR
00371	20430044	SCREW M8X20
00372	20480158	WASHER
00374	20420078	NUT

Index	Partno.	Text
00375	20280124	CASTOR
00380	20054394	SPACER
00381	20480244	LOCK WASHER
00382	20460112	SCREW M 4 X 16
00383	20420076	HEXAGONAL NUT M4
00385	20220405	CABLE TIGHTENING
00386	20220453	LOCK NUT PG 21 M5
00387	20220406	CABLE SHEAT
00390	70907548	Mains cabel 230/3/PE
00393	70056696	Moulding
00394	70056697	Moulding
00395	20290644	SEAL
00400	20210327	MOTOR
00401	70907512	WIRING
00402	20190243	GROUNDING WIRE
00403	20430207	SCREW M 4 X 10
00404	20480108	FAN WASHER A 4,3
00405	20150102	SPEEDINDICATION
00406	20170316	FERROXCUBE
00407	20480242	SECURING WASHER
00408	20460098	SCREW M 3 X 6
00409	20170318	FERROXCUBE
00410	70054603	COVER-FLANGE
00411	20290541	FELT WASHER
00412	20470044	SCREW M 3 X 8
00415	20052927	WASHER
00416	20450081	SCREW M 5 X 55
00417	20049015	SPACER PIPE
00418	20052928	RUBBER FLANGE
00420	70054606	BASIS PLATE
00421	20054605	ANTIVIBRATION MOUNT
00422	10104080	WASHER (SAND)
00423	20510264	SCREW
00425	20430045	SCREW M8X25
00426	20480254	SECURING WASHER
00427	20480158	WASHER
00430	70054616	ANGLE
00431	20430216	SCREW M 6 X 12

Index	Partno.	Text
00432	20480193	WASHER
00435	20180447	IMBALANCE SWITCH
00436	20180446	LEVER
00437	20460093	SCREW M 3 X 30
00438	20480242	SECURING WASHER
00440	70907505	WIRING, IMBALANCE
00450	20280119	WATER-LEVEL
00451	20034416	WRENCH
00452	20005492	BOX SPANNER 10 MM
00453	20360001	SPANNER 8MM
00454	20360008	SPANNER
00500	20150175	PCB 230V 50HZ
00501	20220482	SPACER
00502	20480244	LOCK WASHER
00503	20460095	SCREW PHILIPS M4 X 10
00505	70000599	MICROPROCESSOR
00506	70907572	
00507	70907573	NV RAM
00510	20150104	INTERFERENCE BOARD
00520	20210345	FAN
00521	70054623	CHASSIS
00522	20460096	SCREW M5X10
00523	20510252	SCREW 4,2X9,5
00530	70907521	FAN
00531	70054636	CHASSIS FOR BRAKE FAN
00532	20460096	SCREW M5X10
00533	20480167	FAN WASHER A 5,1
00534	20510174	SCREW 3,5 X 6,5
00600	70907041	EVAPORATOR
00601	20056252	SEAL
00602	20480193	WASHER
00603	20420070	NUT M 6
00604	20480168	FAN WASHER
00605	70054628	SPACER
00606	20510037	THREADED PIN
00607	20500122	PIN
00608	20140501	TEMP. SENSOR
00609	20270054	DELOMET 2301

Index	Partno.	Text
00610	20240595	COMPRESSOR
00611	20430288	SCREW
00612	20480223	WASHER 8,4
00613	20480254	SECURING WASHER
00614	20420078	NUT
00615	20240578	HIGH-PRESSURE CONTROLL SWIT
00620	20240356	CONDENSOR
00621	20430217	SCREW M6X16
00622	20480251	SECURING WASHER
00625	70055876	METAL SHEET
00626	20510252	SCREW 4,2X9,5
00630	20240487	FILTER DRYER
00631	20430250	SCREW
00633	20220134	CLAMP
00634	20260355	COUPLING NUT
00635	70052614	ANGLE SHEET
00636	20430258	SCREW M5X12
00637	20480135	WASHER
00638	20480167	FAN WASHER A 5,1
00639	20420077	HEXAGONAL NUT M5
00640	20210356	FAN
00641	70055616	BRACKET
00642	20480244	LOCK WASHER
00643	20460095	SCREW PHILIPS M4 X 10
00644	20510137	SCREW M 6 X 12
00645	20052555	ANTI VIBRATION MOUNT
00646	10104080	WASHER (SAND)
00649	20430250	SCREW
00655	20049373	BOTTLE
00656	20350187	SECURING SPRING
00657	20290364	HOSE
00658	20220160	HOSE CLIP
00660	20240396	COLLECTOR
00665	20240398	HEAT CHANGER
00670	20240485	INJECTION VALVE
00671	20240421	NOZZLE
00672	20260387	COUPLING NUT
00673	20240341	COUPLING NUT

75007551_03 **CRYOFUGE 8500I 230V/3/50-60HZ HI**

from Serial-No. 272982 **to Serial-No.**

Index	Partno.	Text
00674	20290216	ARMAFLEX
00675	20290212	ARMAFLEX-HOSE
00676	20290291	HOSE ARMAFLEX
00677	20270072	ISOLATION, TAPE
00680	20270100	FREON R 404 A

Calibration Certification Procedure
Cryofuge 6000i/8500i

Revised - 28/05/2001

1. General

Successfully completing the Preventive Maintenance (P.M.) Checklist and Calibration Certification Procedure as outlined will ensure that the instrument is properly maintained and calibrated to Kendro specifications.

2. Equipment Required

- Digital Multimeter
- Temperature Meter with probe
- Stopwatch
- Photo Tachometer
- Safety Tester
- Cryofuge 6000i/8500i Service Manual
- Centrifuge Operating Manual

Note: Check calibration due date on all test equipment before starting certification.

3. Documentation Required

- Preventive Maintenance Procedure and Checklist (Service Manual)
- Calibration Certification Procedure and Form
- Certification Label
- Certificate of calibration for each piece of test equipment used to perform the certification
- Training Certificate

Preventive Maintenance Check

- Perform Preventive Maintenance checks as outlined in the Kendro Service Manual to ensure the instrument is in good working order without performing any calibrations.
- Complete the Preventive Maintenance Checklist. (calibration data will be filled in after Certification)

Calibration Certification

- **SPEED**

Install a rotor, set the speed control to 1000 rpm and start the centrifuge. When the speed has stabilized, measure the actual speed with an external tacho (photo tach on multimeter where speed = frequency[no conversion]). Record measured speed and displayed speed in the speed section of the certification form. Set the speed control to max. rpm and after stabilization, record measured speed and displayed speed in the speed section of the certification form. Determine if the speeds recorded meet the specifications on the form. If the specifications are met, proceed to the next section. A re-calibration of the instrument is not possible.

Calibration Certification Procedure
Cryofuge 6000i/8500i

- **TEMPERATURE**

Place water into the rotor or bucket. Select a temperature of +4°C, maximum allowed speed of the rotor and time of minimum 3 hours. After that record the displayed temperature, measured temperature inside rotor or bucket after rotor has come to rest, in the temperature section of the certification form. Repeat the test at 15°C. Record the values in the temperature section of the certification form. Determine if the temperature values recorded meet the specifications on the form. If the specifications are met, proceed to the next section. A re-calibration of the instrument is not possible. Initial the temperature section. To pre-cool the rotor select pre-cooling program of the centrifuge.

- **TIME**

Using a stopwatch, check the timer by setting a 10 minute run. Start the centrifuge and measure from the time the start button is pushed until the timer switches to stop. Record the measured time in the time section of the form. Determine if the time value recorded meets the specifications in the form. If the specifications are met, proceed to the next section. A re-calibration of the instrument is not possible. Initial the time section.

- **SAFETY TEST**

Using safety tester and connect the centrifuge to it. Measure Insulation resistance.. Select to Earth Conductor resistance and touch with probe all mechanical part of the centrifuge. Resistance must be <0.2 ohms at all points otherwise check for good grounding. Measure accessible current to procedure in the service manual.

Documentation

After filling in the certification information complete the following documentation:

- Log test equipment data on calibration certification form.
- Review P.M. checklist and calibration certification form to ensure that all data and required information has been recorded properly.(including your signature and date)
- Fill out a certification label and place it on the right side of the centrifuge where visible or at a location selected by the customer.
- Ask the customer to sign the calibration certification form and place a copy in the customer's Certification Record Book for that centrifuge.
- Place copies of the P.M. checklist and Field Service Report in the same Record Book.
- Provide copies of your training certificate and test equipment calibration certificates if requested by the customer.

Kendro Service Information

Heraeus Centrifuges

PREVENTIVE MAINTENANCE CHECKLIST

Cryofuge 6000i/8500i
Type
S/N

Rotor Inspection

- Check for corrosion and wear
- Inspect rotor lid locking screw
- Inspect rotor lid
  Serial numbers:
  75006606.....

Preliminary Checks

- Clean inst. & condenser coils
- Rotor chamber (defrost)
- Inst. environment
  (level & clearance)

Pre-run Checks

- Ground continuity
- Line voltage _____V AC
- Display segments on power-up
- Door interlock and latch
- Drive stop & Door unlatch (50 rpm)
- Fan operation (condenser & drive)

Mechanical

- Motor bearings
- Microprocessor Initialization (if required)
- Refrigerant leaks (if required)
- Compressor current draw

Performance Checks

- Acceleration time_____seconds
- instrument top speed _____rpm
- Deceleration time _____seconds
- Time (10 minute set) _____actual min:sec
- Temperature (4° set) _____actual (°C)

Imbalance

- Centrifuge stable and level
- Centrifuge shuts off with proper weight

Safety test

- Accessible leakage current <3500µA
- Insulation resistance >10 Megaohm
- Earth Conductor Resistance <0.2 Ohm

Kendro Service Information

Comments:

S.R. Signature _____
Date of Service _____

Heraeus	**Calibration Certification**	**Cryofuge 6000i/8500i Page 1**

☐ **Preventive Maintenance Checklist Complete**	☐ **Repair and Calibration Recertification**
Account Name:	**Account Address:**
Instrument Model:	**Serial Number:**
Report Number:	**Date:**

Performance Certification

SPEED						
Standard Test			Rotor Used:			
Set Speed (rpm)	Tolerance	Displayed Speed (rpm)	Measured Speed (rpm)	Meets Spec. (y/n)		Passed (Initials)
1000	+/- 10 rpm					
4000	+/- 10 rpm					
Custom Test			Rotor Used:			
	+/- 10 rpm					
	+/- 10 rpm					

TEMPERATURE						
Standard Test			Rotor Used:			
Calibration Temp. (°C)	Tolerance (K)	Displayed Temp. (°C)	Measured Temp. (°C)	Meets Spec. (y/n)		Passed (Initials)
+4	+/- 2					
+15	+/- 2					
Custom Test			Rotor Used:			
	+/- 2					
	+/- 2					
	+/- 2					

TIME					
Standard Test		Rotor Used:			
Timer Set (min.)	Tolerance (sec.)	Measured Time (m/s)	Meets Spec. (y/n)		Passed (Initials)
10	+/- 30				
Custom Test		Rotor Used:			
	+/- 30				
	+/- 30				
	+/- 30				

TEST EQUIPMENT			
Type	Model	Serial Number	Date of Next Calibration
Stopwatch			
Temperature Meter			
Photo Tachometer			
Safety Tester			

	SAFETY TEST	
Insulation resistance >10 Megaohm	Earth Conductor Resistance <0.2 Ohm	Accessible Current <3500µA	

Revised 24/7/01

Certified By:_____ Reviewed By:_____ Expiration Date _____

Signature Date Customer Signature Date

Änderungsnachricht Nr. 323

1. Technische Änderung
Umstellung von Kunststofftischplatte auf Stahltischplatte

2. Änderungsgrund
Die Kunststofftischplatte ist nicht mehr lieferbar

3. Betreffende Geräte
Von dieser Änderung sind alle Cryofugen 6000i und 8500i betroffen, bei denen ein Defekt an der Tischplatte vorliegt und diese ausgetauscht werden muss.
Bei Geräten, Seriennummer >238182 ist die Stahltischplatte bereits serienmäßig eingebaut.

4. Änderungsdurchführung
Bauen sie den Deckel ab und entfernen sie die alte Tischplatte. Siehe entsprechenden Abschnitt im Service Manual.

Folgende Neuteile werden benötigt:

1 x 70900701 Tischplatte
1 x 20056252 Dichtung
2 x 20500179 Gewindestange
2 x 70056254 Abdeckung Schloss
1 x 70056253 Tasterblende
1 x 70056259 Tasterblende innen
1 x 20054650 Folie
6 x 20440298 Senkschraube M4 x 12
6 x 20420124 Käfigmutter M4
8 x 20420076 Sechskantmutter M4
8 x 20250074 Polyamidscheibe 4,3
4 x 20460094 Linsenschraube M4 x 8
4 x 20480244 Federring 4,3

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Technical Bulletin No. 323

1. Engineering Change
Technical change of the plastic bench-top to the steal bench-top

2. Reason for Change
The plastic bench-top is no longer available

3. Reference to Units
This change is valid for all Cryofuges 6000i and 8500i where the bench needs a replacement.
Units above serial 238182 have already the steal bench-top installed.

4. Modification
Remove door and old bench-top from the unit. See section in service manual.

Following parts will be required:

1 x 70900701 bench-top
1 x 20056252 seal
2 x 20500179 threaded bolt
2 x 70056254 cover latch
1 x 70056253 cover
1 x 70056259 plate, inner
1 x 20054560 overlay
6 x 20440298 counter sunk screw M4 x 12
6 x 20420124 housing nut M4
8 x 20420076 hex nut M4
8 x 20250074 polyamid washer 4,3
4 x 20460094 fillister-head screw M4 x 8
4 x 20480244 spring washer 4,3